SUPERMAN—THE MOVIE

FEBRUARY 1979 #8

FUTURE

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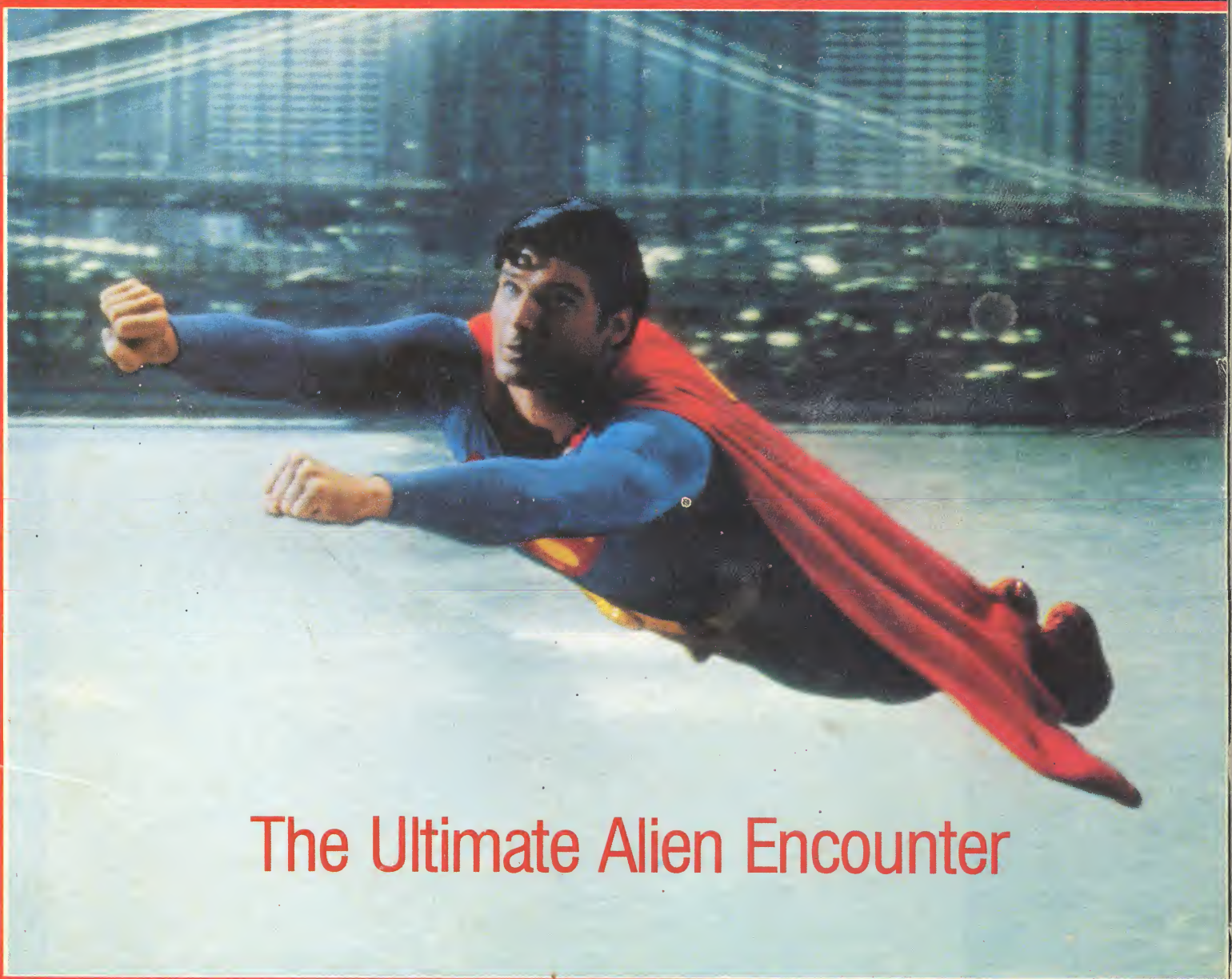

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Wally Schirra: The Earth From Space • Astral Architecture
Jerry Pournelle's Factual Fiction • Ted White's Future Rock
Space Art By David Hardy & Adolf Schaller

"INTERPLANETARY OLYMPICS, 2020" © 1978 BY DAVID HARDY. SKIING ON THE METHANE ICE OF JUPITER'S MOON, EUROPA. SEE DAVID HARDY PORTFOLIO/INTERVIEW ON PAGE 58.

The Magazine of Science Adventure

FUTURE

FEBRUARY 1979 #8

FEATURES

DEPARTMENTS

FUTURE
FEBRUARY 1979 #8

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ON THE COVER: Superman (Christopher Reeve) soars over a great metropolitan area in a shot from **Superman—The Movie.** A new special-effects technique was used to make the flying sequences in the film more realistic-looking than anything previously done. Photo: © 1978 DC Comics.

ON THE CONTENTS PAGE: An imaginative vision by artist David Hardy, entitled "Interplanetary Olympics, 2020." This cross-country skiing event takes place on the methane ice surface of Jupiter's moon, Europa. (See David Hardy Portfolio/Interview on page 58.)

output

Generally this magazine projects a positive, optimistic view, and we have good reasons for doing that. The technological advances on the horizon promise a better life for every human, in every way.

But sometimes it is unavoidable for us to face hard unpleasant negatives in order to solve them and clear the way for the positives of the future. A perfect example is a recent report by McGraw-Hill's Department of Economics. The report is the fourth in a series of surveys among experts in various technological fields, asking for their best estimates as to when scientific breakthroughs will occur and when these advances will actually be in widespread use.

The predictions are exciting and inspiring. For instance, just in the category of Medical, Biological, Health and Hospital:

(a) Direct electronic communication with/and stimulation of the brain—breakthrough: 1985, widespread use: 2000.

(b) Ultrasonics to detect brain tumors—breakthrough: 1979, widespread use: 1985.

(c) Effective weight and appetite control—breakthrough: 1985, widespread use: 1995.

(d) Means of hastening fracture healing—breakthrough: 1978, widespread use: 1988.

(e) Cancer cure—breakthrough: 1985, widespread use: 1990.

(f) Artificial eyesight for the blind—breakthrough: 1981, widespread use: 2000.

(g) Biochemicals to cure mental illness—breakthrough: 1990, widespread use: 2010.

(h) Major reduction in hereditary and congenital defects—breakthrough: 1980, widespread use: 2000.

(i) Chemical control of senility—breakthrough: 1990, widespread use: 2000.

(j) Increase in life expectancy to 100 years—breakthrough: 2000, widespread use: 2005.

(k) Drugs to permanently raise level of intelligence—breakthrough: 1992, widespread use: 1992.

That's just a small sampling of the incredible *medical* advances we can look forward to. If these predictions prove accurate, most of us living today can expect our health to improve and our life to extend, perhaps long enough for even more advances to be made, and who knows where that could lead? The immortality Robert Anton Wilson discussed in FUTURE #6 may be closer than anyone can predict.

There's just one catch: the last time this same survey was taken (1975) the predicted dates were generally *sooner.* By the next report, the predictions might be even *later.* Why? The McGraw-Hill report states, "Certainly fading research and development expenditures inhibits the pace of innovation."

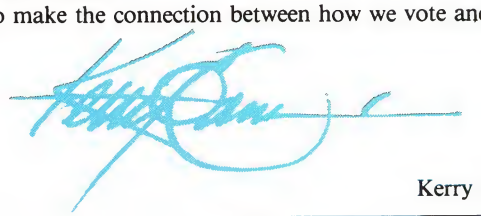
In other words, once again Inflation rears its ugly head. In FUTURE #5 "Output" I spoke of a small way in which government economic controls, "free" services, and increased spending harms everyday life—the way taxes affect the price of this magazine. Now, we see that Inflation also causes the pill or injection or technique that might heal your disease or repair your organs or extend your life or *save your life*—to be moved farther away from your grasp!

Technological research is enormously expensive. An individual project must be funded for many, many years with no profits to justify it. This kind of long-range research can flourish only in a healthy, predictable economy in which huge "excess" profits can be generated for whatever time is needed to complete the research and development.

Inflation is the enemy of long-range experimental research!

The next time elections roll around and we are searching for a reason to get involved, to support a candidate or a proposition—we should think about the ways in which Inflation constantly pushes the technological advances of the future farther and farther away from our lifetimes.

We must learn to make the connection between how we vote and our very existence.



Kerry O'Quinn/Publisher

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Because of the large volume of mail we receive, personal replies are impossible. Comments, questions and suggestions are appreciated, however, and those of general interest may be selected for publication in future issues. Write:

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SPACE: THE 50'S FRONTIER

. . . I was very happy to see your story about the 1951 Space Program (FUTURE #5). I have been a follower of the space program since those stories originally appeared. Enclosed is a picture of myself holding the copies of those *Collier's* magazines, 1952-1953. I am a retired Air Force man who served over 22 years and was very involved in the Thor and Atlas Program. It is a pleasure to find a magazine that brings out new ideas as well as old theories about space and our future. Hope you will continue the good work.

J.R. Hamilton
Omaha, NE

ELLISON: PRO AND CON

. . . In response to letters from Ronald N. Waite of Trenton, N.J., and Michael Villa of Holyoke, Mass.

To Señor Waite, pride of America's Garden Spot, sumptuous Trenton, N.J. (stay downwind, pardner): not everyone who came to America came voluntarily, my thimble-brained friend. *Most* blacks in America will happily tell you—just before thumping your skull to knock some sense into it—that their ancestors came here stacked belly-to-butt in the holds of slave ships. Same for them funny little slanty-eyed yellow folks, whose great grampas were schlepped here by Jim Fisk and other railroad barons to work driving high iron on the transcontinentals. And even those who came happily, seeking freedom and a fresh start, are entitled to full civil rights. "All of a sudden everyone has rights. . ." you said. Commendable of you to have figured that out all by your tiny self. Everyone *does* have rights. Some of which are even guaranteed by the most Amurrican of documents, The Bill of. As to who cares? The answer is a simple and pellucid one: *we* care, snookie. . .those of us who shake our heads dolefully, grit our teeth and realize we will have to share this potentially terrific world with louts such as you.

To Holyoke's best argument for making birth control retroactive, Monsieur Villa: even in deep coma, Joanna Russ would know more about what she was talking about than you do at your most lucid moments, which very likely occur only on the occasion of the birth of a two-headed calf. That you are so insensitive that you think *Star Wars* had no message is ample demonstration of the truth that yours is a head that has never been sullied by the presence of a coherent thought. You call Joanna "a nonconformist, attention-seeking troublemaker," which puts her in the same group with Jesus of Nazareth, Henry David Thoreau, Emma Lazarus, Oscar Wilde and Isadora Duncan (which ain't such dusty company), as opposed to all those conforming followers of the rules with whom you clearly identify, none of whose names I can readily summon up, and whose gifts to humanity are no doubt boundless but who somehow seem to have passed into the dust heaps of eternity having left no discernible mark on the world.

You manage to get off a carom shot about me, I note. You say I have "already given SF writers a bad name." Do I take your meaning correctly that I, alone, all by me widdle self have given *all* SF writers a bad name? (I can see it now: Robert Heinlein steps up to be honored by the American Red Cross for his yeoman service with the blood drives and one of the dignitaries turns to the other and says, "Hey, isn't he a SF writer." The other one furrows his brow and says, "Damn. *Ellison*'s a SF writer, too, and you know what a bad name he's given them!" The guy holding Bob's trophy turns on him and bashes him across the skull with it. "Take that, kin to the foul Ellison!")

Well, I'd just love to go on like this indefinitely but my father, God, has just appeared to me in a vision and said it ain't nice to kick cripples. One parting shot for the editors of FUTURE, who are doing one helluva job to make this magazine a publication that transcends the imbecility of some of its readers: don't let pimples like these guys bother you. Keep running material like Gerrold's Briggs article and keep mixing the future of the real world with the cinematic fantasies that keep these buffoons slap-happy. You do service for all, and nothing but commendations are due you. Lift their consciousness, even where none seems to exist. And remember the old adage, "Everyone is entitled to his/her opinion," isn't precisely accurate. It ought to read, "Everyone is entitled to his/her *informed* opinion."

Harlan Ellison
California

PROTECTING YOUR FUTURES

. . . It has come to my attention that no effort seems to have been made to provide a protective file box for FUTURE magazine, as has been done for STARLOG. I have written and requested information from the Jesse Jones Box Corp. concerning this matter, and they have told me that they know of no such magazine as FUTURE. I have bought the STARLOG protective files in the past and found them to be excellent. Could you submit a design to the Jesse Jones Box Corp.? I am sure that not only I, but other FUTURE readers and collectors as well would appreciate it.

Jorg A. Ronke
Virginia Military Inst.

Jesse must have been on vacation the day you wrote. By the nicest coincidence, they have just completed samples of our new FUTURE slipcase and portfolio box designs. They are jet black with silver stamping on the front and spine. Each protective case holds a full year of FUTURE (eight issues) and makes a handsome addition to library shelves. See the ad elsewhere in this issue.

MORE PRINT, PLEASE

. . . I am currently subscribing to both STARLOG and FUTURE magazines. Excellent! Finally, magazines that combine intelligence, creativity and quality. One section in FUTURE that I enjoy immensely is "In Print." I believe that it would be a very popular decision to expand this section, allowing more SF books to be reviewed.

Kevin Wright
Kirkland, Quebec
Canada

As you can see, we have revamped our "In Print" section. Each issue of FUTURE will now feature an "In Print" column, spotlighting a host of related books, plus a "Books in Brief" section, offering mini-reviews of publications hot off the presses.

CORRECTION

In FUTURE #7's article on "Careers in Space" the opening color photograph of astronaut Rhea Seddon (page 70) was mistakenly credited to NASA. The picture should have been credited to James L. Long Associates. Also, the contents page photo of the Apollo launch at night is © 1978 by Ctein.

GAY RIGHTS REACTION

We received an unusually large volume of mail in response to David Gerrold's "Sen. Briggs vs. SF Fandom" in FUTURE #6. The following excerpts are an accurate reflection of the deluge. (Note: the Briggs amendment was soundly defeated on Nov. 7 by a 58% to 42% margin.)

. . . I have read several of the books listed, some of which I fail to see the connection, but David Gerrold, I'm behind you *all* the way!

Sue Manley
Rookville, PA

. . . I'm in opposition to homosexuals, but David Gerrold's article was a refreshing outlook on the subject. It needled the brain and it also brought up some frightening aspects: in my opinion, a person should be able to obtain and read *any* literature. Let's not forget the Nazi book burnings. You people tell your editor to relax. If an article like Gerrold's can make an anti-gay dude like me think a little, it was worth

(continued on page 8)

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(Continued from page 6)

printing. I'm looking forward to reading other thought-provoking articles to come in FUTURE.
Terry L. Rockhold
Continental, OH

...I agree with your stand on (Gerrold's) article wholeheartedly. I *want* to see speculation on future *social* issues as well as future technological issues.
Laurie D.T. Mann
Pittsburgh, PA

...I get a great deal of enjoyment out of seeing such issues as ERA and gay rights brought up in what *appears* to be an SF mag. For too long SF fandom has been a closed circle of people who dreamt of a future utopia as a way of blocking out today's realities. I'm sure your magazine is jarring to many. I guess what I like is that it is designed to appeal not just to the SF fan, but to the futurist instinct in all of us.
Gerry Mooney
Tulsa, OK

...As a gay man and a science-fiction fan, it's a joy to find both aspects of my life supported under one cover.
Colin Alexander
San Francisco, CA

...Mr. Gerrold is to be congratulated. I feel that too often the subject of homosexuality is clouded because no one is considering the fact that two men or two women may actually have feelings for each other. It would seem to me that the same thing that makes a man and a woman fall in love makes two men or two women fall in love. If you really love a person, sometimes sex is a by-product of that love. I am withholding my name because I am gay and should you decide to publish this letter, well, I have friends who read your magazine and I would rather they didn't know. They just don't understand.
Name withheld by request
St. Louis, MO

...Congratulations! It's nice to know someone has the guts to publish an article that is sure to bring controversy. Senator Briggs' bill goes totally against the Constitution of the United States. Prohibiting courses about homosexuality violates the rights of students and is stupid—prejudice is a result of ignorance. I believe that what Mr. Gerrold says is true: it *is* unimportant if someone happens to be gay. Besides, Infinite Diversity in Infinite Combinations is delightful, right?
Beth Johnson
Hickory, NC

...In this uptight world, we need all the friends we can get. I would be proud to have a friend I could be close to, whether he was homosexual or not. By the way, so far I am heterosexual. Someday I hope we can love without putting tags on each other. Thanks, David Gerrold. It was a good message.
Mary Stoakey
Tahlequah, OK

...As a teacher in California, I'm particularly aware of the damage Prop. 6 and its advocates can cause. Thank you for printing the piece.
Name and address withheld by request

...Sometimes I feel put out by people who think that some kind of miraculous salvation awaits humankind in the depths of interstellar space. The greatest opportunity before us is, as always, the exploration of the human spirit. "Sen. Briggs vs. SF Fandom" does more to substantiate your claim to a serious interest in the future than all the technological fantasy you could ever publish!
Stephen Lortz
Anderson, IN

...I am in complete agreement with Mr. Gerrold. A very close friend just revealed to me that he is gay, and I did not react with disgust. Because of this, our friendship has grown closer. I have a point to add to Mr. Gerrold's rather long list: prisons. Homosexuality should not be forced on anyone—it should be his/her choice. Has the Honorable Senator Briggs thought of that? If he is so all-fired hot to "protect" kids from homosexuality, why doesn't he start in the prisons? Some of the people in prisons are under 18. This is where the brutal homosexuality usually starts.
Name withheld by request
San Antonio, TX

...I am not gay, but I do favor gay rights. The time for action is now. Let's not just sit around and let it happen. Let's tell our governors, senators and people in office what we think of gay people. I feel that all people should be treated equally.
Tim Knapp
Hudson, NY

...I depend on FUTURE to present me with these issues that may have a profound effect on the world of tomorrow. And if you do not continue to present such issues, your sales will fall like matter into a black hole.
Doug Kelley
Wilmington, DE

...I appreciate Mr. Gerrold's opinions on the future. I disapprove of homosexuals, but I disapprove of witch hunts even more.
Richard A.C. Conde
Nashua, NH

Now for a few words from the opposition:

...Mr. Gerrold's prime target appears to be legislation outlawing the employment of homosexuals in California public schools. He completely misses the key point: *public* schools, funded by California taxpayers. Parents who must, by law, educate their children are not being unreasonable in asking that homosexuals not serve as role models for their children. Nor is it unreasonable that they should ask that homosexuality not be taught in the schools, any more than bestiality, necrophilia or any other abnormal behavior be taught.
Mark Koldys
Dearborn, MI

...Let me applaud one of your editors for objecting to the homosexual article by Gerrold in FUTURE. I'd uphold his opinion much more if he'd included some words about an article like that being dangerous to the health of young

(continued on page 10)

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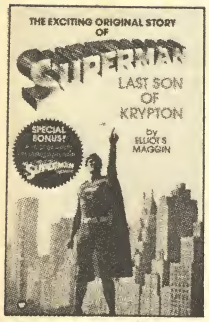

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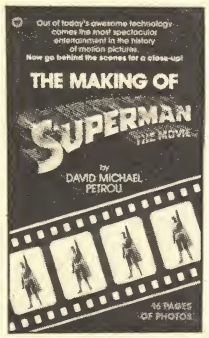

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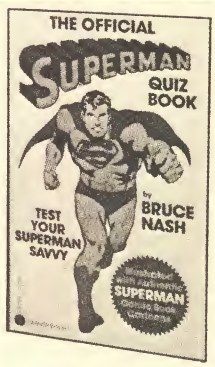

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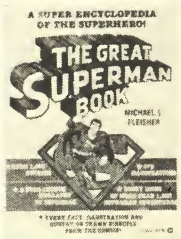

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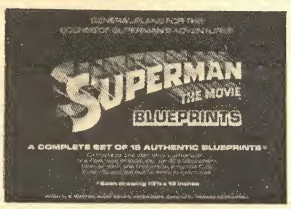

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(Continued from page 6)

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Indianapolis, IN

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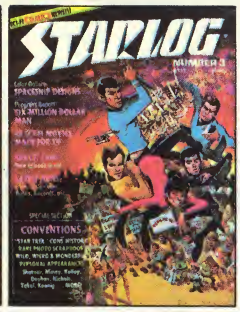

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"Star Trek" Convention, Spaceships, "1999" Year 2 Guide, SF TV Movies Guide

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3-D Part 2, "UFO" Guide, "Star Trek" Censored, SF TV Address Guide, Space Art

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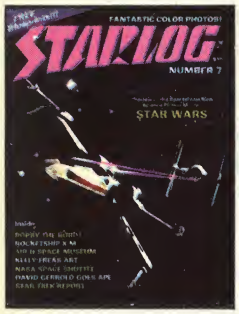
"Fantastic Journey," "Star Trek" Animated, Special Effects—Part 1



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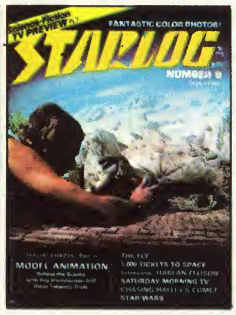
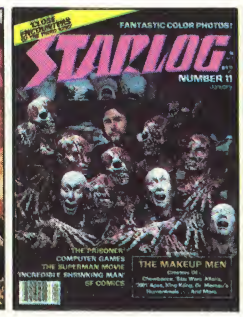
"Star Wars," Robby the Robot, Eagle Blueprints, "Star Trek" Report



No. 8
Model Animation, "The Fly," Harlan Ellison Interview, Set. A.M. TV, NASA Space Tix

No. 9—
Interviews: Pet Duffy, Lynde Carter, Shatner, Jered Mertin, *Fantastic Journey* Guide, *Star Wars*, 50s TV SF.

No. 10—
Asimov, *Close Encounters* preview, SF-Rock, SF Merchandise Guide, Interviews: Herryhausen, Bakshi, George Pal.



No. 11—
The Prisoner, Computer Games, The Superman movie, *Incredible Shrinking Man*, SF FX: The Makeup Men, SF Comics.

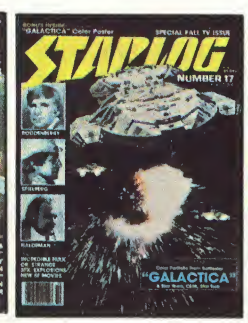
No. 12—
Close Encounters feature. *Star Trek II*, Computer Animation, *Laser Blast*, Art by Bonestell, The Makeup Men, cont.

No. 13—
Logan's Run Episode Guide, *3001*, Disney's Space Films, *The Time Machine*, David Prowse Darth Vader

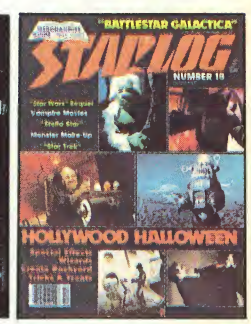
No. 14—
Virgil Finlay art, Jim Danforth interview, "Project UFO." *Capricorn One*, *Star Wars*: P.S. Ellenshaw.

No. 15—
This Island Earth, Episode Guide "The Twilight Zone", Sound Effects, David Gerrold: "Death Beast", chap. 1

No. 16 —
The Invaders Episode Guide Solar Power Satellites Bob McCall's *Buck Rogers* Art Interview: Alan Dean Foster



No. 17 —
Special Fall TV Issue "Galactica" Color Poster Interviews: Spielberg, Roddenberry SFX: Miniature Explosions



No. 18 —
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SPACE

Russians To Rescue Skylab?

When the space shuttle was expected to start flying in March, 1979, it looked like there would be plenty of time to rescue Skylab—the errant 80-ton space station now in a decaying orbit around Earth. But main engine problems pushed the shuttle launch date back to June, and when those were resolved, gremlins showed up in the software of the shuttle's control system. Now NASA is aiming for a September launch date—one that is perilously close to the time Skylab will plunge to the planet in flames. The second shuttle flight, scheduled to handle the rescue mission, may be too late.

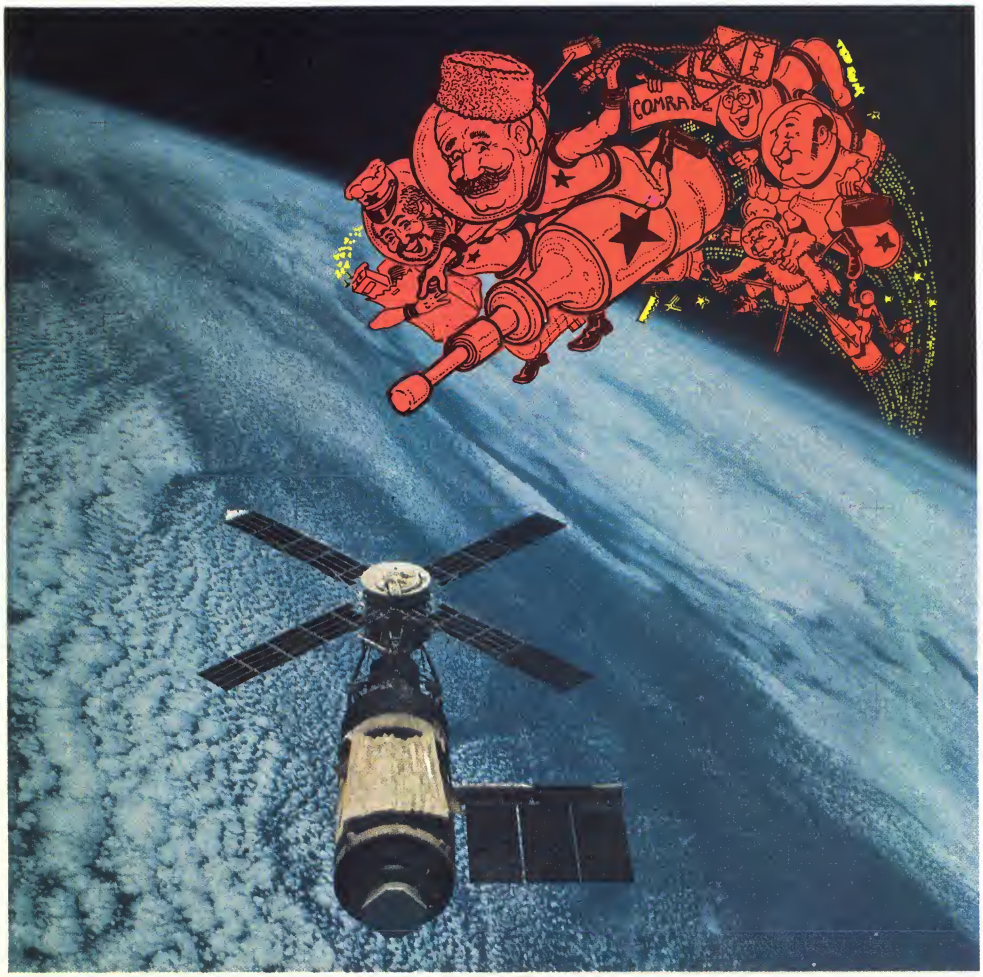


PHOTO NASA ART © 1978 TED ENIK

Last-minute rescue scenario: Will the U.S. Government allow the Soviets to save Skylab?

What happens if the shuttle isn't ready in time? There's still one other possibility, although high echelon NASA officials deny that it could work. According to informed sources at NASA, the Soviets could give Skylab enough of a boost to keep it aloft for another nine months. Here's how the Russian rescue would work:

A piloted Soyuz craft (which the Soviets always have on hand) would rendezvous with Skylab. NASA would have to provide a lock adapter, and thanks to the Apollo-Soyuz mission experience, the job should be relatively easy. The Soyuz craft (which normally rendezvous by homing in on a transponder) would be guided by mission control in Houston. Given the experience the Soviet cosmonauts have recently gained in their Salyut space station, they should be able to cope with most docking problems that might arise.

The Soviets have evidently given this project some thought. Several years ago they approached the U.S. with a request to use Skylab. The request was denied. But chances are that the Soviets made a serious study of the problems of rendezvous and orbit boosting before making the request. The Soviets are anxious to avoid public embarrassment. They would not have asked permission to use Skylab if they thought there was a significant risk of not being able to board it.

Angered at Soviet human rights violations, the Carter Administration has opposed any activities (such as a Skylab rescue operation) which would allow the Soviets to obtain new technology from us.

So NASA is officially *not* considering the Russian rescue scenario. Will Skylab fall to Earth, a casualty of software bugs and crumbling detente? Or will it hang in there long enough to be saved and recycled? Further news as it develops.

—Carolyn Henson

PEOPLE

ARTHUR C. CLARKE WRITES AGAIN!

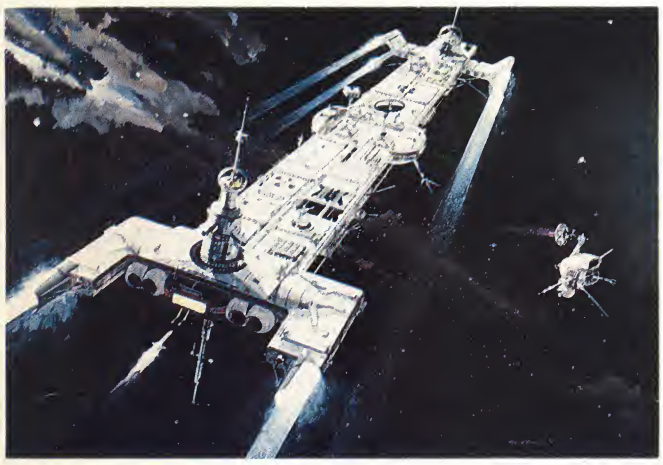
More than 20 years ago, world-famous scientist and science-fiction writer Arthur C. Clarke went to Ceylon. Out of his initial visit came *The Shining Ones,* a book inspired by his two-decade love affair with skin diving, and the seed of what was to become, in his own words, "the most ambitious thing I have ever done." The "thing" is *The Fountains of Paradise,* a massive novel set for 1979 publication by Random House.

"I've just finished," he says, "and it has everything in it: Buddhist philosophy, ancient history and the ultimate space transport system." The main locale is "Adam's Peak," a gigantic geological monolith in Ceylon which is sacred to almost every religion. "Christians and Moslems say Adam's footsteps are on the summit, Buddhists say it must be Buddha's mark and the Hindus say the footprint is that of the god Shiva."

Not only is Clarke's latest literary work quite possibly his most audacious and controversial, he also feels it may be his last. "I've said everything I wanted to," he told FUTURE's editors earlier this year. "For the first time, I have nothing more to say." *—Richard Meyers*

PHOTO COURTESY CRAVEN FILMS

Famed science-fiction writer Arthur C. Clarke has just completed a new novel, set for 1979 publication.



ART: COURTESY BOB McCALL

Bob McCall's pre-production art for *The Black Hole:* an early concept of the half-mile long starship *Cygnus,* bound for encounter with space void.

FILM

DISNEY PROBES THE BLACK HOLE

Walt Disney Studio's on-again, off-again science-fiction spectacular *Space Probe,* is definitely on again, bearing a new title—*The Black Hole.* The $17 million dollar epic was recently described by Disney vice-president Ron Miller as "our most ambitious picture yet. We are going to renew our reputation as the studio known for its special effects."

The movie, which went into pre-production under the aegis of the late Winston Hibler, has been a source of problems to the studio since its inception. . . primarily in terms of storyline. After Hibler's death in 1976, the then-untitled film was given to Peter Ellenshaw to develop, and *Space Probe* was born. After further modifications of the story, a final script by Jeb Rosebrook and Gerry Dey was accepted and retitled *The Black Hole.*

The most expensive film in the history of Disney Studios, *The Black Hole* has been declared top secret; barred not only to the press, but also to Disney technicians. Only a handful of people on the studio lot know the ending of the movie, which will feature the Disney version of what is on the other side of a mysterious black hole. Two film units will be working on the movie simultaneously, but independent of each other. Neither unit will ever know what the other unit is filming in an effort to keep the project totally hush-hush until its release.

Starring Maximilian Schell, Anthony Perkins, Robert Forster, Joseph Bottoms, Ernest Borgnine and Jennifer O'Neill, *The Black Hole* deals with the voyage of the starship *Cygnus,* a half-mile-long craft which encounters a void in space. Geared as a straight science-fiction adventure, the film will be the first "adult" concept produced by the Disney team in some years. The studio's aim, according to Miller, is to attract the SF fans who made *Star Wars* and *CE3K* so successful. "We think this is a great opportunity to get those people who think Disney is a bad name to take a look at one of our films," he told a motion picture trade publication recently.

Backing up Miller's plan for an adult approach will be an astounding array of special effects headed by Peter Ellenshaw, the artist responsible for the mattes and effects for Disney's *20,000 Leagues Under the Sea* and who won the SFX Oscar for *Mary Poppins.* Ellenshaw's son, P.S. Ellenshaw, who did mattes for *Star Wars,* will head the matte department for *Black Hole.* Visual and mechanical effects, which include the use of a $500,000 computer to repeat camera movements ala *Star Wars,* will be handled by Art Cruikshank, Danny Lee and Eustace Lycett. Frank Phillips will be director of photography, Bill Thomas costumer and Gary Nelson will direct.

Miller, who will serve as *The Black Hole's* producer, says that the late 1979 release will be previewed via a one-hour NBC *Wonderful World of Disney* "making of" segment.

—David Houston & Joseph Kay

MEDICINE

TOE TO FINGER TO "TINGER"

Surgeons at Presbyterian Hospital in Oklahoma City have come up with a new appendage by means of a novel microsurgical technique. Called a *tinger,* it looks like a toe, acts like a finger and could lead to a whole new way of life for accident victims who have lost their fingers. Last October, doctors transplanted a toe onto the right hand of Rodney Beige. Beige, 31, lost his fingers in an industrial accident in 1977 when fumes from liquid propane gas he was pouring caused him to pass out and spill gas onto his hands.

The transplant was made during a 12-hour microsurgery operation; an event which employs tiny surgical instruments in order to connect tendons, nerves and blood vessels of the toe to the hand. The operation took place last October 10. By October 18, Beige was able to move his tinger and was looking forward to both writing with his right hand again and regaining the ability to "just pick up things." The operation was so successful that Beige may have more tingers grafted onto his hand in the future. *—William Pratt*

ARTIFICIAL INTELLIGENCE

ROBOT OR RIP-OFF?

For the past 18 months, the New Jersey-based Quasar Industries has been making news from New York to Honolulu with their self-proclaimed Quasar robot. The highly publicized, cone-shaped invention, written up in *Newsweek, Parade, The New York Times* and STARLOG and featured on both TV talk shows and the *Logan's Run* TV series, is the brainchild of Anthony Reichelt, the president and founder of Quasar.

In an interview with STARLOG magazine earlier this year, Reichelt claimed that his robot could, with modifications, "read fairy tales to children, teach French, climb stairs, monitor for smoke and fire and serve as a burglar alarm." Now, according to some experts, the modifications needed for the Quasar robot to live up to his advance publicity include two men: one holding a hidden microphone, thus providing the voice, and the other operating a small remote-control unit to allow for locomotion.

In a recent article in *ROM,* the magazine of computer applications for living, a report points out that, indeed, the Quasar robot may not be anything but a very sophisticated toy. The report recounts the adventures of two researchers who encountered a Quasar robot named Sam Strugglegear at a Pittsburgh department store.

After watching the robot perform in a too-good-to-be-true manner, the duo stumbled upon the fellow with the hidden microphone. A second unit of investigators, determined to find the secret of Sam's intelligent movements, discovered a fellow loitering in the back of the room carrying a flight bag: contents unknown. Although they never actually saw the insides of the bag, they witnessed a store official allegedly asking the man to move the robot. Moments later, the robot apparently did just that.

To complicate matters, a similar incident on New York's CBS-TV local news prompted charges of fake to be uttered on the air. During a routine demonstration of a Quasar robot on camera, CBS newsmen discovered the alleged operator of the droid. Camera shy, the man fled from the room. The robot stopped operating immediately. Reichelt, however, insists his robots are real. To CBS news he vowed, "Wait until around Christmas." At that point, a Quasar robot will visit the studio and perform independently of any shady characters. So far, no robot has shown its cone at the station.

—William Pratt

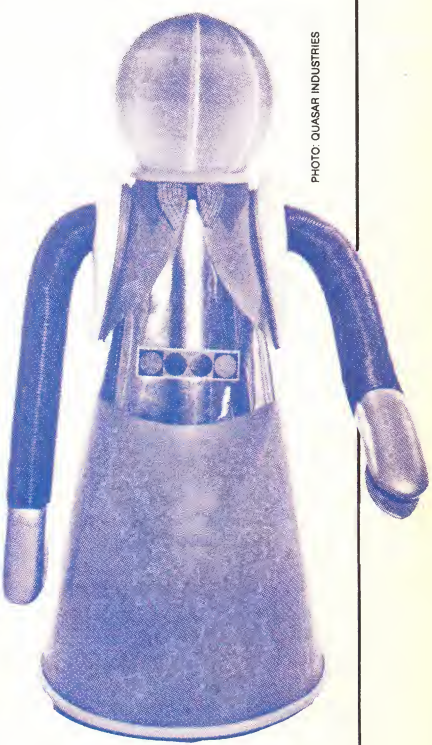


PHOTO: QUASAR INDUSTRIES

Quasar Industries' so-called "domestic robot." Recent observations indicate it's less a robot, more of a toy.

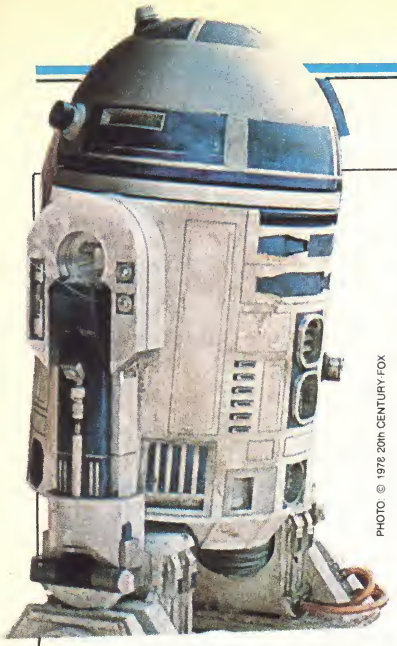


PHOTO © 1978 20th CENTURY-FOX

INTERNATIONAL NEWS

CHINESE CALL R2-D2 "RUNNING DOG"

People's Daily, the authoritative mainland Chinese newspaper, has finally gotten around to reviewing *Star Wars*. The verdict: anything but boffo. Pien Yiping, the paper's movie critic, labels the space fantasy "movie chop suey," then goes on to find a deeper meaning behind the space battles, robots and aliens.

"(*Star Wars*) reflects the discontent of the American public and the hope of finding consolation in the world of illusion," reads the translation from the Chinese mainland. "80 percent of the cost was spent on special effects. But how long can this rush last? The American film industry is destined never to be able to find a true way out because the entire capitalist culture is dying."

Ironically, the remainder of the article lambasts the Chinese film industry for not keeping "pace with developments in filmmaking. (Filmmakers) must make full use of the cinematic art and techniques to produce films that will be more spectacular and colorful."

So watch out—your next fortune cookie may have a light saber in it.

—Richard Meyers

SATELLITES

GLOBAL MUSIC

History was made recently when the rock band Jethro Tull performed live before the world's largest rock audience ever, reaching some estimated 400 million people around the globe. The concert was held in New York's Madison Square Garden and was beamed live via satellite to British TV audiences on the BBC-2 station and to listeners of Britain's John Peel Show on Radio One. The event marked the first time a rock concert was broadcast live from America for European television and the first time that a TV and radio simulcast has been beamed from the States.

PHOTO: CHRYSALIS RECORDS

Flamboyant flutist Ian Anderson just before satellite concert.

As BBC-2 and Radio One received the Tull signals from space, the Eurovision Network transmitted the show to other Western European countries and Intervision fed the show to European countries behind the Iron Curtain.

Tull leader Ian Anderson, a fairly pastoral lad with a yen for the flute, had no comment on his group's rock 'n' rolling scientific milestone. He did, however, agree to pose with a model of an antique satellite. Better jiving through science. *—Al Flyn*

FILM

ASTRONAUT IN ARMOR

With equal dashes of history, whimsy, slapstick and science, Walt Disney Productions is bringing its newest fantasy to the screen—*The Spaceman and King Arthur.* Don Tait wrote, Russ Mayberry directed and Ron Miller produced this modern fairytale of knights, lasers, jousts and androids in the spirit of Mark Twain's *A Connecticut Yankee in King Arthur's Court.*

Dennis Dugan stars as astronaut Tom Trimble, who becomes a knight errant when his space shuttle taps a time warp and winds up in the year 508 BC. Sheila White plays his slightly addled lady love, Alisande, Kenneth Moore portrays the noble King and Ron Moody is featured as the crafty wizard, Merlin. Rounding out the cast are Jim Dale as the villainous Sir Mordred and John Le Mesurier as Sir Gawain the Square.

PHOTO © 1978 WALT DISNEY PRODUCTIONS

Disney's pseudo-space shuttle on location at an English castle for *The Spaceman and King Arthur.*

But the special-effects men are the real stars in this fanciful comedy. The large production team, headed by Cliff Culley and Ron Ballinger, did most of its heavy work on location at the Alnwick and Raby castles in Northumberland, England. In the rain-soaked countryside, the intrepid craftsmen fired the spaceship's retrorockets into a clutch of medieval warriors, blasted the craft's "jet-pack seat" hither and yon, handled the fire chores in a battle and burning-at-the-stake sequence and both launched and landed the "Stardust One."

The Stardust One, vaguely modeled after NASA's space shuttle, is a 25-foot-long construction with a ramp which lowers to reveal a "Moon rover"—a neat four-foot package which lengthens to seven feet, sprouts various screens, solar disks and even a hydraulic arm along the way.

Other effects incorporate the talents of art director Albert Witherick, costume designer Phyllis Dalton and makeup man Roy Ashton. Witherick built an impressive "King Arthur's Court" at Pinewood Studios, complete with a 120-foot hall and the famous Round Table. Dalton designed over 600 outfits, from the everyday attire of local peasantry to the sumptuous apparel of Merlin. Ashton had a special task to handle in the form of Hermes, the spaceman's look-alike robot sidekick.

Scheduled for a summer of 1979 release, *The Spaceman and King Arthur* is one of Disney's more expensive and audacious projects in recent years. *—Richard Meyers*

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For the first time, a soundtrack record of the classic 1950 movie of Man's first step into space.

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Composer Ferde Grofe is best known for his "Grand Canyon Suite" and other classics. The theremin, a wailing electronic instrument used in Hitchcock's "Spellbound," is heard in the Mars sequences.

A "must" for SF fans and soundtrack collectors, the jacket includes photos and extensive background notes.

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About a year before Herrmann's death, he composed and conducted a moody, mysterious score for "It's Alive," an SF-horror tale of a monster, mutant baby. The success of the film led to a sequel, and Herrmann's music was lovingly and respectfully reorchestrated and conducted by his dear friend Laurie Johnson. It's not party music; it's a score for those who want to dim the lights, get into a dark mood, and listen carefully to some wonderful musical chords and effects, including bizarre instruments such as twin synthesizers. The score to "It's Alive 2" (complete on this record) will recall the entire range of Bernard Herrmann's golden years in film music.

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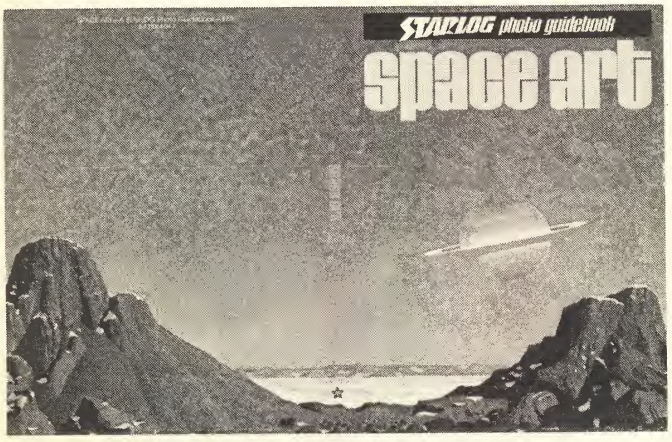
NEW BOOK

SPACE ART SHOWCASED



New painting by Chesley Bonestell adorns cover of *Space Art*.

A Martian duststorm, volcanoes on Titan, starships stranded on distant planets, the first human expedition to another solar system . . .only a few of the unearthly visions found in *Space Art*, the most ambitious STARLOG Photo Guidebook published to date. The 200-page, large format softcover book contains more than 100 color reproductions of stunning astronomical art, painted by the masters in the field (from Chesley Bonestell to Bob McCall), as well as some little-known but talented newcomers just launching their celestial careers.

Compiled and written by STARLOG/FUTURE's Space Art Advisor, Ron Miller, the book is believed to be a first in the publishing field.

"It is the only book entirely devoted to the field of space art," reports publisher Kerry O'Quinn. "The artists working in this field are some of the finest painters in the world. Yet space artists have never received the serious recognition they deserve."

The works of more than 60 artists are included, ranging from early conceptions of the lunar surface to detailed astronomical paintings based on the latest information about the cosmos. . .to startling science-fiction visions of the future in space. Chapters on the archeology of space art, artist biographies and helpful hints on where to see and how to purchase space art are included.

Space Art retails for $7.95 in bookstores. It may also be ordered from STARLOG Photo Guidebooks; see page 79 for more information.

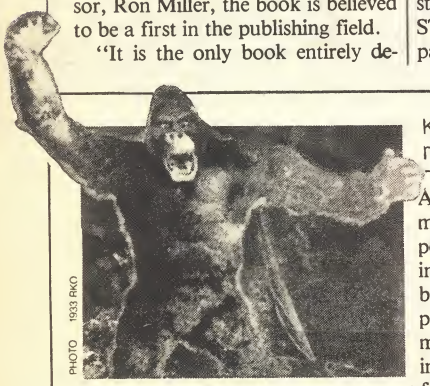


PHOTO 1933 RKO

Kong goes ape for *Altered States*, new mindbender in the making.

FILM

MONKEY BUSINESS NO JOKE IN "ALTERED STATES"

Production is due to start on Columbia's SF thriller, *Altered States*, a frightening tale of science gone awry, based on Paddy Chayefsky's bizarre novel. To be directed by Arthur Penn, *States* concerns the misadventures of a scientist who experiments with mind-altering drugs in order to find the genetic time bridge between humans and their prehistoric counterparts. The experiments draw him deeper and deeper into a mental world of primordial feelings and soon his body begins to follow suit.

Set to helm special effects is John Dykstra's newly formed Apogee Inc. Dykstra, of course, is best known for his mind-blowing visuals in both *Star Wars* and *Battlestar Galactica*. Blair Brown, who co-starred in TV's *Wheels*, has been signed as the film's lead, and it's rumored that makeup master Dick Smith is working on some pretty hairy designs for the production. —*Charles Bogle*

MUSIC TECHNOLOGY

SYNTHESIZED ROCK IS HERE TO STAY

Larry Fast loves synthesizers. At the age of 20 he built a set of customized electronic modules for Rick Wakeman of the rock group Yes. In the six years since that time, Fast has distinguished himself in the realm of electronic music, working with Dr. Robert Moog on designing an early prototype of the polymoog synthesizer, touring and recording with such rock artists as Nektar, Peter Gabriel and David Spinozza and recording several synthesized albums of his own under the stage name of Synergy.

As leader of Synergy, Fast has unleashed three LPs: *Realizations for Rock Orchestra, Sequencer* and *Cords* (the latter two on Passport Records). Terming his music a "new classical form," Fast attempts to take synthesizers to their ultimate musical limits, introducing new electronic wrinkles along the way. On his newest LP, *Cords*, Fast introduces the use of the "super sequencer," sort of an electronic sideman which plays synthesizers automatically. Because it uses microcomputers, however, it's able to store more of Fast's music instructions and execute more maneuvers than a standard sequencer.

Another innovation present on *Cords* is Fast's guitar synthesizer, an invention that, for the first time, enables a synthesizer to detect up-picking, account for all the notes in a "slide" up or down a guitar string and cope with the decreasing amplitude of a string once it is picked. In short, it allows a guitarist to use *all* normal guitar-playing techniques when employing synthesized sound.

Despite his achievements, Fast, still a consultant for Moog Music, Inc., has no plans to rest on his laurels. He envisions devoting his life to searching for new means of creating spacey music and to continue to "explore the use of electronic technology in creating art forms." —*Ed Naha*

Electronic musician Larry Fast with his latest innovation—guitar synthesizer.

PHOTO PASSPORT RECORDS

MEDIA

SPACE HEROES, SPACECRAFT FEATURED IN STARLOG #20

SF media personalities abound in STARLOG #20, which goes on sale Tuesday, January 23. There is a 50th anniversary salute to the original space hero, Buck Rogers; a revealing look at what makes Robin (Mork) Williams and Pam (Mindy) Dawber America's favorite inter-species romance; a behind-the-scenes story on the latest Saturday morning hit, *Jason of Star Command*, and the complete story on the making of the newest SFX-travaganza, *Superman—The Movie*.

STARLOG #20 also presents a three-sided view of spacecraft—from flying model rockets and building cinematic miniatures, to NASA's latest plans for ion-powered exploratory craft.

CONTEST

STARLOG/FUTURE ANNOUNCES SHORT FILM COMPETITION

For the first time, amateur filmmakers will have the opportunity to gain professional status and receive fame and exposure—not to mention cash prizes. STARLOG and FUTURE magazines are sponsoring the first annual SF Short Film Search, open to all filmmakers, whatever their experience and budget.

Films may be submitted in 8mm, Super-8, or 16mm, and although there is no limit on length, 5-15 minutes is most desirable. The subject can be anything that falls within science fiction, future, horror and space fantasy; it can be humorous or serious; it can include animation, stop-motion, live-action or any combination.

The entries will be viewed by a panel of film experts, and the winners will be announced and screened at the Balticon (Baltimore) April 13-15, 1979. *Deadline for submitting finished films is April 1, 1979.*

Provided you take photos and otherwise document your step-by-step making of the film, this material may be used in an article on the winning entries in STARLOG and/or FUTURE. Best of all, if the winning entries are of high professional quality, STARLOG/FUTURE plans to package the films for wide commercial exposure—an opportunity to boost you into the motion-picture limelight and produce income in addition to your prize money.

Any films produced within the past two years, 1977-78, are submittable, and if you don't have a finished film, we suggest you get to work immediately on the script and designs. For detailed rules, fees, releases and entry forms please write today:

SF Short Film Search
Dave Ellis
4221 White Ave.
Baltimore, MD 21206

Please note that you do not have to attend Balticon to participate in the SF Short Film Search, but if you would like information on attending, please request it specifically when you write. Lights. . . Camera. . . Action!

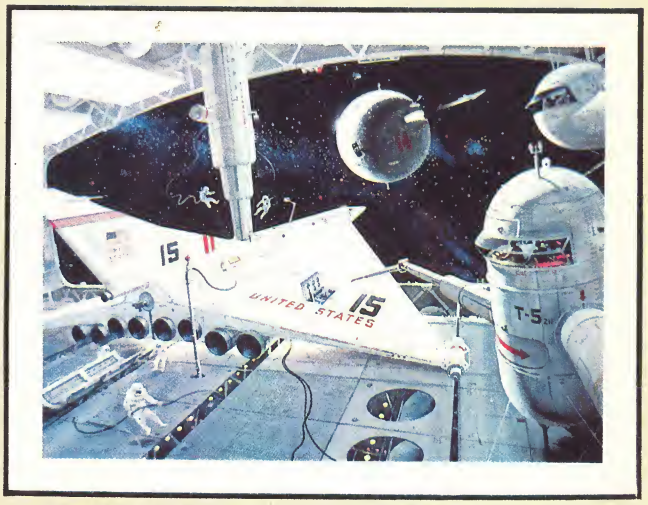
ART: HOWARD CRUSE

SPACE ART

BONESTELL ON VIEW

The dean of American space artists, Chesley Bonestell, will have a one-man show at the Rosicrucian Egyptian Museum in San Jose, Calif., from December 20 through January 21. On display in the museum's art gallery will be Bonestell's fine art as well as his space paintings, including several new works. Of special interest, a four-by-eight-foot canvas entitled "Our Galaxy, The Milky Way."

NEWEST RELEASE



SPACE ART CLUB Print #1, "Space Station 2000" Painted by Bob McCall

"Space Station 2000": In the docking port of a future space station (like the one seen in the distance), a sleek spacecraft is serviced. The spacecraft is a second-generation shuttle, one that is less of a truck and more of a taxi, smaller and more maneuverable than NASA's current space shuttle. The multi-purpose space station is a scientific laboratory, astronomy outpost and spacecraft service station. Located in high Earth orbit, the massive human-built spheres are way stations for travelers between Earth and Moon—and the starting point for expeditions setting out to explore the Solar System.

Bob McCall: Isaac Asimov has christened Bob McCall the "artist-in-residence" of outer space. Since his seminal paintings for *Life* magazine in 1964, McCall's work has given us some of the richest, most immediate images of the space age to date—and some of the most compelling visions of what the future might bring. His six-story mural for the Smithsonian Air and Space Museum in Washington, D.C., is a glorious tribute to our accomplishments in space. McCall is currently at work on another large-scale mural for the Johnson Space Center in Houston—this one depicting the history and future of flight.

It's too late to join FUTURE's Space Art Club, but *if you hurry* you can still purchase individual prints as they are issued. The Club's first print is "Space Station 2000" by renowned space artist Bob McCall. A limited number of the high quality, fine art prints will be available for a short time. Cost for the 18″x 24″ suitable-for-framing print is $10. Prints will be mailed in reinforced cardboard tubes. Postage and handling cost is $2. So if this spectacular vision of the future by one of America's favorite space artists appeals to you—order now! When the Space Art Club runs out of prints, that's it. This is a strictly limited edition. When our supply of prints is gone, money will be returned.

ORDER TODAY!

Mail orders to: FUTURE Magazine
475 Park Avenue South
New York, N.Y. 10016

_____Print #1, "Space Station 2000" by Bob McCall
$10 each, plus $2 postage/packing
Total enclosed: $_____

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City, State & Zip Code

If you do not want to cut up this page, type order on a separate sheet of paper.

STARLOG/FUTURE

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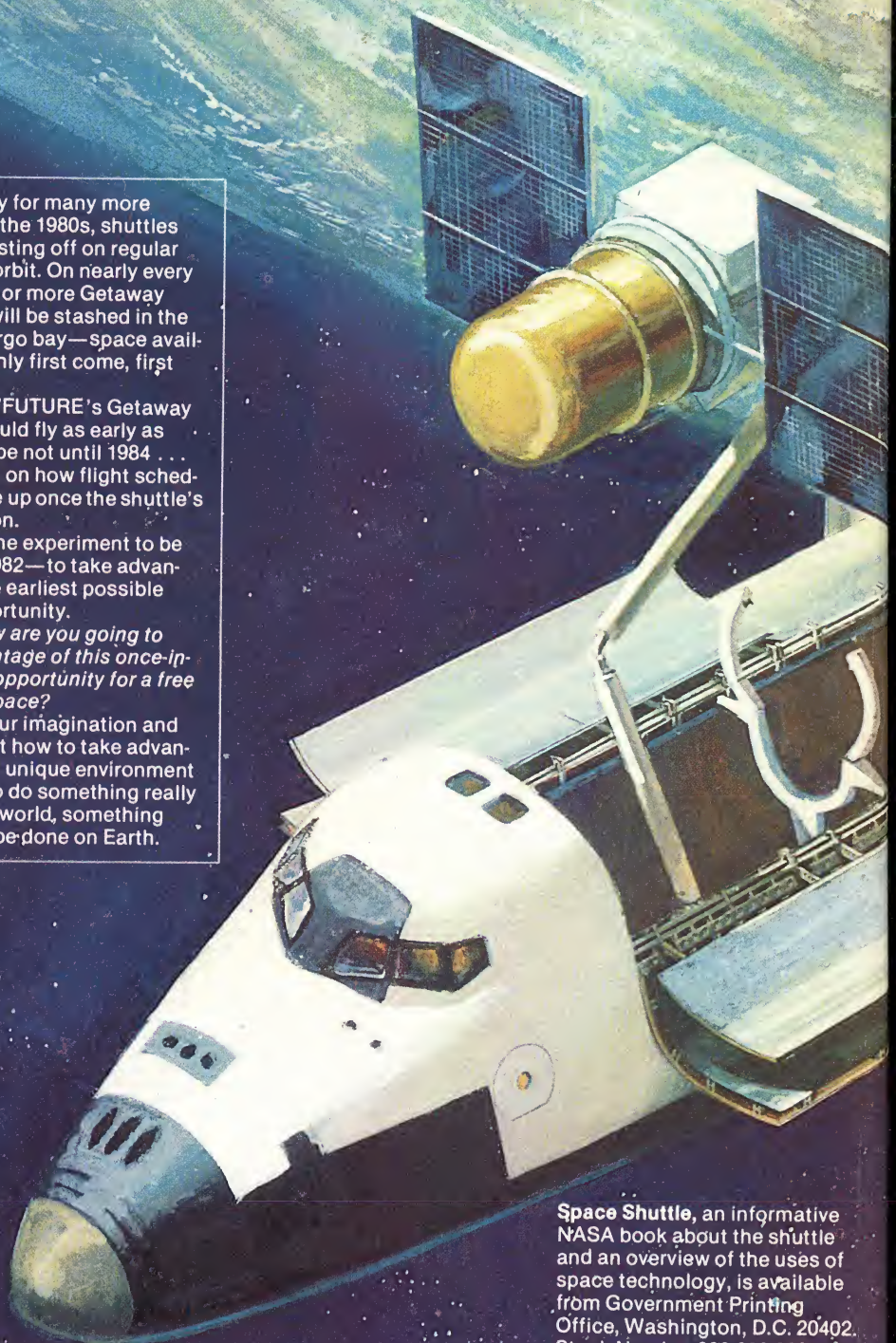
Come up with the best idea



We've put money down on a Getaway Special, a bargain-priced (at $10,000) passage for an experimental package into space and back—aboard the space shuttle.

And we're giving it away—to the person (or people) who come(s) up with the most interesting proposal for what to do with it.

What pet theory, bright idea or burning question would you like to test in space? Here's your chance for a free ride on the space shuttle to the ideal laboratory for testing out ingenious ideas about what can be done in the unique environment of space.

Make an amazing breakthrough discovery—the patent's yours! We'll pay the bill for your experiment's trip into space.

The Getaway Special is NASA's way of demonstrating how the space shuttle, with its cost-cutting features, will make doing things in space an affordable reality for many more people. In the 1980s, shuttles will be blasting off on regular flights to orbit. On nearly every flight, one or more Getaway Specials will be stashed in the shuttle cargo bay—space available, roughly first come, first served.

STARLOG/FUTURE's Getaway Special could fly as early as 1982, maybe not until 1984 . . . depending on how flight schedules shape up once the shuttle's in operation.

We want the experiment to be ready in 1982—to take advantage of the earliest possible flight opportunity.

Now—how are you going to take advantage of this once-in-a-lifetime opportunity for a free ride into space?

Turn on your imagination and think about how to take advantage of the unique environment of space to do something really out of this world, something that can't be done on Earth.

Some things about the GETAWAY SPECIAL:

It can weigh up to 200 pounds.

It can have a volume of up to 5 cubic feet.

It must fit into a cylindrical container less than 20" in diameter, just over 28" long.

It must not fall apart when subjected to launch vibration or bumpy, high-speed landing.

It must be completely self-contained. That means:

It must have its own power supply (none available from the shuttle).

It must be automated, able to do whatever it will do with the help of 3 on-off signals from the shuttle crew.

It must have its own data-collection system, if it needs to collect data *in space*. (Some experiments might simply require inspection on return to Earth.)

It must be able to withstand temperature extremes from -50° to 200°, or

If it needs to maintain a constant temperature, it must have its own thermal control system.

If it's alive (that is, any life form higher than molds, insects and plants), it must be cared for according to National Science Foundation guidelines on experimental animals.

It may have a lid to open to space, or

It may have a vent to admit vacuum, or

It may be perfectly sealed.

It may be in space anywhere from 24 hours to one week.

It will stay in the shuttle cargo bay and be returned to Earth.

How to get started:

If the opportunity appeals to you, but you a) don't know much about the space shuttle, b) don't know much about what's been done with zero-gravity, vacuum and the space environment before, c) aren't immediately seized with the perfect idea or d) all of the above, here are a few places to look for general information:

Space Shuttle, an informative NASA book about the shuttle and an overview of the uses of space technology, is available from Government Printing Office, Washington, D.C. 20402. Stock Number 033-000-00651-9. Price. $3.40.

NASA Office of Education, Dr. Fred Tuttle, NASA Headquarters, Washington, D.C. 20546. Ask for a list of NASA and Government publications about what's been learned in space.

Libraries, local scientific institutions; etc. Use your ingenuity, do a little research . . . see what you learn along the way.

Place On the Space Shuttle

for how to use it — and it's yours

STARLOG/FUTURE's Getaway Special Advisors

G. Harry Stine, author of *The Third Industrial Revolution* and NASA consultant on space industrialization studies, is an expert on the space shuttle—and on the potential uses of the "natural resources" of space.

Leonard David, program director for the Forum for the Advancement of Students in Science and Technology, has fielded hundreds of requests for information on student experiments on the shuttle.

Jesco von Puttkamer, Senior Staff Scientist in Advanced Programs at NASA Headquarters and regular science columnist in FUTURE, has been involved in space industrialization studies with NASA for years. His knowledge of space science is well-known to readers of "Science Notebook" in FUTURE.

In addition, several more advisors who are experts in various space-related fields will be selected to assist with final selection of STARLOG/FUTURE Getaway Special Winner.

Who can enter:

Anybody: students, nuclear physicists, high-energy astronomers, biologists, metallurgists, photographers, artists, gardeners—whatever. You may enter as an individual or as a group. You may enter more than one idea (separate prospectus, please).

How to enter:

Send us a *one-page* typed prospectus on what you want to do with the Getaway Special. Make it a brief, clear statement of your experiment idea—what you hope to accomplish, test, demonstrate and/or find out in space, and how you plan to do it.

The prospectus must include the following information typed on the back side of the same page:

1) Your name (or if it is a group entry, the name of the group plus the name of *one* person who will serve as contact for the group).
2) Address (street, city, state, zip code).
3) Phone number.
4) Your age (or, for group entries, age range).

Mail your prospectus to:

STARLOG/FUTURE Getaway Special
475 Park Avenue South
New York, N.Y. 10016

Entries must be postmarked no later than July 20, 1979, the tenth anniversary of the first Moon landing.

Prospectuses will be reviewed by STARLOG/FUTURE's panel of Getaway Special Advisors. Before a winner is chosen, a number of contestants may be asked to submit more detailed proposals for final judging. Getaway Special winner will be announced in December, 1979.

STARLOG/FUTURE can assume no responsibility for material submitted. Keep copies for yourself. We can acknowledge receiving your prospectus only if you enclose a self-addressed, stamped postcard. No material will be returned. Prospectuses longer than the *one-page* limit will not be considered and will not be returned.


BORIS

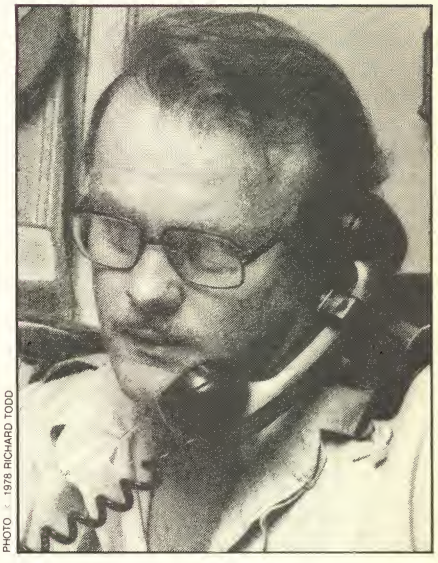


PHOTO © 1978 RICHARD TODD

Jerry Pournelle

From Space Science to Space Opera

When SF author Jerry Pournelle made the leap from scientist to science-fiction writer, he found the transition easy. Science, it seems, means everything in Pournelle's brand of SF

By JEFF ELLIOT

I have nothing against *literary* science fiction," Jerry Pournelle says, "but I don't really care for it myself. I don't think I'll ever attempt it. In fact, I don't know if I ever *could* write the sort of SF that's filled with intense character study and symbolism. I'm a scientist-turned-writer. I guess that shows."

During an era of "mass appeal" science fiction, Jerry Pournelle is one of a dying breed...an SF writer still obsessed with science. A rugged Renaissance man who feels at home in the great outdoors, Pournelle holds PhD's in political science and psychology, a masters in experimental statistics and bachelor degrees in engineering and history. A former college professor, he was also involved in the aerospace industry as a working scientist for ten years, including two years as chief of the Experimental Stress Program of Boeing's Human Factor Labs. Since turning to science fiction less than a decade ago, he has penned such popular works as *High Justice, The Mercenary* and *A Spaceship for the King.* With Larry Niven, he has co-authored *Inferno, The Mote in God's Eye* and *Lucifer's Hammer.*

Relaxing in his southern California home, the burly winner of the first John W. Campbell Jr. award is fairly candid about his preference for nuts-and-bolts science fiction. For him, the connection between science fiction and science fact is clear cut...and a necessity.

"I've always been a fan of science fiction," he begins. "Especially *hard* science fiction. In fact, many people in the space program were avid SF buffs. I really became a science-fiction writer because I couldn't do anything else."

The author emits a rumbling chuckle. "Actually, at the outset of my career, I was deeply involved in science fact—the space program. Then, in the mid-1960s, the bottom dropped out of it. It became obvious that NASA wasn't going to get the funds for anything beyond the Apollo mission. I was employed, at the time, by North American Aviation, the space division of Rockwell International, as a senior scientist in the company. Unfortunately, they were forced to make major cutbacks in the number of people in that position. As a result, they offered me the job of managing the Operations-Research Department. I knew, though, I couldn't do it. I didn't even try. I realized that I wouldn't be any good at trying to coordinate the work of 200 people, as well as doing the accompanying administrative work and paperwork."

Pournelle took a teaching job at Pepperdine University, founding a research institute in his spare time. After a short stint as the assistant director of research for the City of Los Angeles, he found himself out of school, out of politics and out of a job. It was only then that Pournelle dove head first into SF writing. "It was a natural move to make," he shrugs. "As I said, I had been closely involved in the advanced planning phase of the space program. I also knew how to write. In fact, I used to tell Robert Heinlein and Poul Anderson, both of whom I've known for over 20 years, that I did the same work as they did, except I didn't have to create characters to go with the ideas. It really wasn't a big jump from that to writing science fiction, especially since I had done considerable research on alternative futures and technologies."

Pournelle found his aerospace background invaluable. "I can't conceive of writing the kinds of things I write without having been a working scientist," he concedes. "The real problem is trying to keep up with everything. It's no simple trick. Like most writers, I make a living by pretending to know everything."

The author's science-oriented style met with immediate success, although he professes to have absolutely no idea about what his unique style consists of. "Truthfully," he laughs, "I don't pay much attention to style. In fact, some people might readily believe that after reading one of my books. I'm not particularly interested in creating 'literature.' My goal is to tell stories—stories which amuse, excite and interest my readers. Now, that doesn't mean that writing style isn't important—it is. However, my primary objective is to entertain, not educate.

"From my point of view, the story, the plot and the characters are the most important ingredients. The way the story is

Pournelle's scientific bent shows up his fiction hardware: here, laser-powered spacecraft, painted by Boris for the cover of Pournelle's Ace Book, *Exiles to Glory.*

ART © 1978 BORIS VALLEJO

"... The problem with SF is that the ideas take up so much running space that there's not much room left for in-depth characterization."

PHOTO © 1978 RICHARD TODD

told will take care of itself. I enjoy writing science fiction. It's easy to do and I'm familiar with the material. It also lets you get across your view of the world, which is something I like doing. All my work reflects my own view of the world, particularly my view of science and technology. As I see it, not all technology is good, but it's certainly not all bad. It affords you a host of choices. For example, if you don't have access to penicillin, you have no choices when it comes to treating pneumonia. As a result, there's a theme in my work which says, 'While science gives you choices, those choices represent both good and bad.' In many of my stories, though, the wrong choices are made, which is the way things work in real life.

"I don't think there's a way you *cannot* express your own philosophical viewpoint in science fiction. It's an integral part of the work. When Horace Gold was the editor of *Galaxy*, he received a telephone call from Ted Sturgeon who said, 'Horace, I can't write the story I promised you. I'm too concerned with the McCarthy hearings. I've got to write something which says how I feel about what's happening in this country.'

" 'Fine,' Horace said, 'I want you to sit down and write me a story about a man who drives down to the bus station to meet his wife, who's returning from a vacation. When she gets off the bus, the man notices that she and a young man sitting behind her exchange a very peculiar glance. Now, write me that story. If you're any kind of writer, your ideas about the McCarthy thing are going to appear in that story, because you can't help yourself.' I think that's a very profound observation. I don't think it's possible for a writer to write something without expressing his own ideas one way or another. Science fiction is a literature of *ideas*."

As much as Pournelle respects SF for its infinite scope in terms of ideas, he believes that good SF can *only* be written after sound scientific research has been conducted to base the idea upon. "I do a good deal of research," he reveals. "In this area, I have an advantage over a lot of other science-fiction writers. For several years I've been the science columnist for *Galaxy*, which requires me to keep abreast of what's going on in terms of research. I wangled myself that job primarily as an inducement to keep up on the state of things. I've never made a profit from writing the column, but it's a good way to justify all the time I spend reading science publications.

"The research is totally necessary. It generates the settings for my fictional stories. Sometimes it will also suggest a character or a unique plot twist. It's easy to do the research. The tough part for me, though, is coming up with a storyline. A good writer can't limit himself to research. It's necessary to invent your own story. That can't come from the research alone. You can't become a writer by just reading the journals. There's also the creative end of it.

"I try to convey an accurate view of science, however. One which is in accord with known fact. But again, I'm writing science *fiction,* not science *fact*. It's necessary to take liberties when you're writing fiction of any kind, especially science fiction.

"However, I'm very concerned that my writing reflects science *fact*. I'm perfectly willing to engage in prognostications, which, I suppose, is a big failing of mine. However, I'm not capable of writing a story, other than pure parody, unless I believe it *could* happen. That doesn't mean it *will* happen, but if I don't believe that it could, then I'm not capable of writing it. Perhaps one day I'll invent a fantasy world in which to write, but I doubt it. For example, I don't believe in vampires, but I'm willing to believe in scientific possibilities which have yet to be realized. I can't make myself believe in ideas which are limited to pure imagination. That's too much of a step to take, particularly for me. Some writers can do it and get away with it. I'd rather not even try. Science is my forte.

"I don't know how important imagination is in the context of my work. I don't know what that word means. Where does homework end and imagination begin? Obviously, if you have a good logical sense, you don't have to have as fine an imagination. However, both things overlap and are extremely helpful when it comes to writing good science fiction. If you only have one of the two, you're likely to run into problems."

Since Pournelle places a heavy emphasis on hard science in his work, he has garnered criticism for his approach to characterization. He acknowledges his characters' back-seat position in his novels, but doesn't particularly see it as detrimental. "The problem with science fiction, I think, is that the ideas themselves take up so much running space in the typical science-fiction novel that there's not much room left for in-depth characterization. Generally speaking, novels of characterization fail in SF. They often receive critical acclaim, but they don't sell especially well. Most science-fiction readers aren't particularly interested in those kind of books. That's not why they read science fiction." With a slight grin, Pournelle adds hastily, "God knows, I could be wrong on that."

Immeshed in science fiction and science fact up to his eyeballs, Pournelle relishes the opportunity of piling up even more material via future columns and excursions into fiction. And just how does this science maven, this omnivorous reader and devotee of logic relax? Pournelle blinks and reveals his secret of inner peace... a secret that may shock his nuts-and-bolts legions.

"I like SF conventions," he says. "Basically, writing is an unnatural act. You spend most of the time in a room with the door closed, totally alone, except for the people you've created in your stories. In fact, you probably spend at least one third of your waking life in this unnatural environment. It's a wonder that any of us are fit for social intercourse. As a result, it shouldn't be terribly surprising that writers prefer to hang out with other writers who understand the world in which they live. For me, conventions are ideal for meeting people who share my interests. It's easy to strike up an interesting conversation with practically anybody."

And so for one of science fiction's most scientifically accurate laureates, the secret to success lies in a perfectly calculated mixture of hard science and... human contact.

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ASTRAL ARCHITECTURE

By JOHN KEPLER

Fact: only one five hundred billionth of the Sun's energy reaches Earth. The rest radiates out in all directions into space and is wasted. So on a planet whose current energy sources are drying up, it could easily be said that our Solar System is in need of major reconstruction for the efficient use of the Sun's energy. And according to a theory devised by Freeman Dyson, this reconstruction is not only possible, it is highly likely. The reason: *exponential growth.*

An ancient Persian tale illustrates the concept. A craftsman made the King an exquisite chess board of alabaster and onyx. The King, grateful for the gift, asked the craftsman what he wished in return. "I ask little," replied the craftsman. "Merely one grain of wheat for the first square of the board, two for the second, four for the third, 16 for the fourth and so on." The King quickly agreed to so modest a request. The 14th square required 512 grains, the 15th 16,384, the 21st more than a million, and the 40th a million million. The King never fully paid the craftsman, for the volume of wheat to cover the last square would have exceeded the size of Earth.

It was the extraordinary potential of exponential growth for producing rapid and seemingly uncontrolled increases in population which led Thomas Malthus, in the late 18th century, to propose the inevitability of poverty and suffering. Population would always outrun production. In the early 1970s, Malthusian ideas again came into vogue when the Club of Rome, an international group of industrialists, published *Limits to Growth*, a book which suggests that just about all food and resources are going to run out within 50 years. There seems to be only one problem, though, with Malthusian predictions of disaster—they don't come true. Not only has industrial and technological growth in the past more than kept up with growth in population, it has far exceeded it, and the potential for the future is virtually unlimited.

If we go back for a moment to our image of exponential growth, we find the world's population currently growing at a rate of three percent. This growth rate doubles the population approximately every 35 years. Most population experts expect the rate of population growth to decline, to perhaps one percent. This figure doubles the world's population every 69 years, but even at the slower rate of growth, population and the related consumption of energy can grow to an unimaginable size. Suppose we assume that the world's existing reserves of fossil fuels will last us 100 years at the current rate of use. Suppose we also assume that the growth rate in fuel consumption grows at one percent per year. In 2,500 years, at this greatly increased rate of consumption, how long would the same fossil fuel supply (which lasted us 100 years) last? Answer: *three tenths of one second*! Exponential growth.

The first thought is that such population growth and energy consumption are not possible; natural or human-made causes will intervene to prevent it. Yet a second thought is that they *are* possible, indeed likely, and that there *is* a largely untapped source of immense energy to fuel our future growth: the Sun.

The idea that the Solar System might be reorganized so that most of the Sun's energy could be captured for use was suggested as long ago as 1895 in a book entitled *Dreams of the Earth and Sky* by a Russian scientist named Konstantin Tsiolkovski. Tsiolkovski imagined that it would take millions of years to reorganize the Solar System, but today's estimates see the task being accomplished in only a few thousand years.

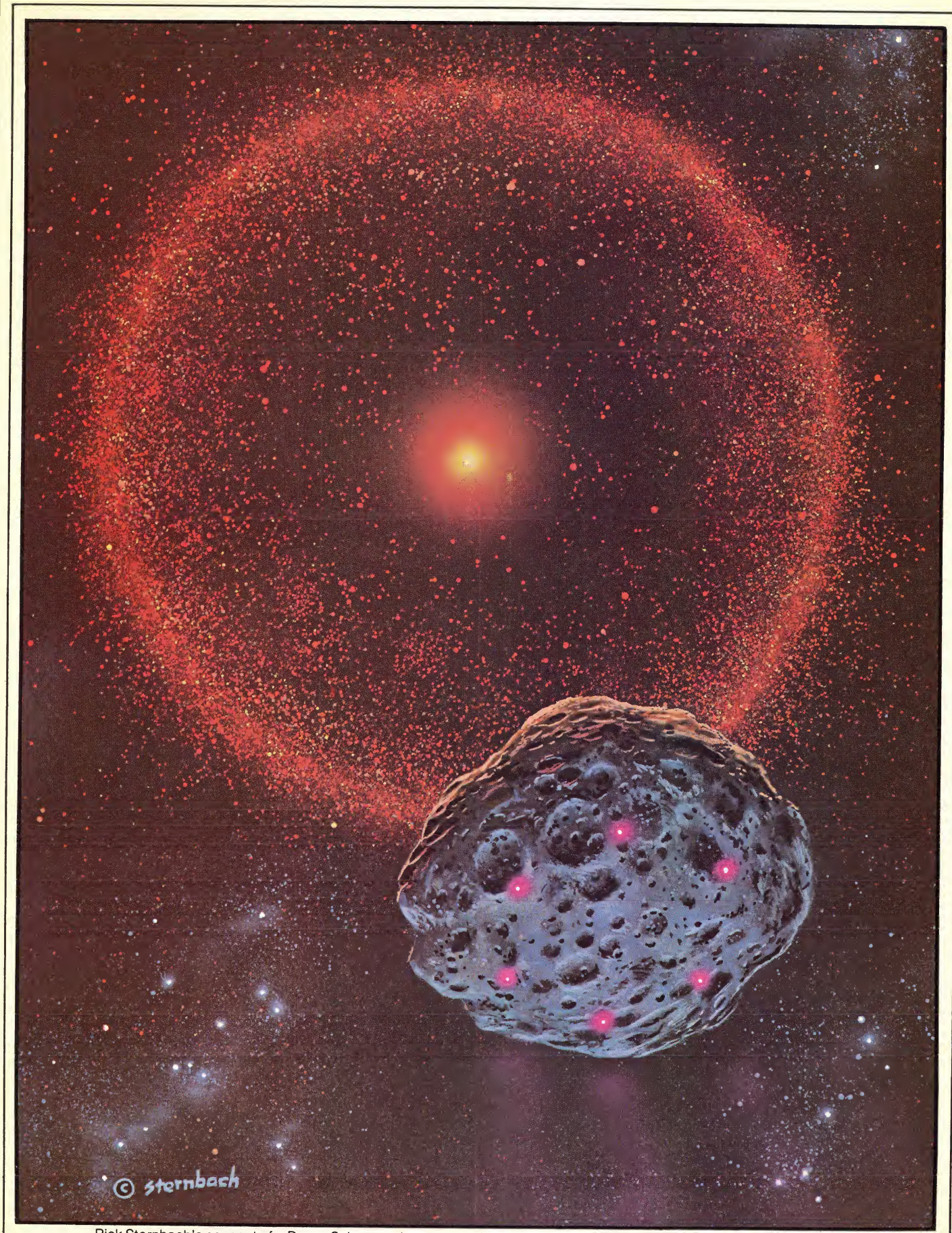
Most prominent among those speculating today about the reorganization of the Solar System is Freeman Dyson, a theoretical physicist at the Princeton Institute for Advanced Study. In an article published in 1960, Dyson suggested that one of the larger planets in our Solar System, such as Jupiter, could be dismantled, and the material could be used to construct an immense shell with a diameter the size of Earth's orbit—completely surrounding the Sun. Some astronomers estimate that there are several million intelligent civilizations in our galaxy, and that Dyson's theory may be a logical phase for such civilizations to evolve through.

Such a shell—a Dyson Sphere—would be a few meters thick, and would capture all of the energy radiated by the Sun. Of course this energy could not really be captured, since that would lead to a continuously increasing buildup of heat. Rather, the Sun's energy would strike the shell, heat it up to, say, 72°F, and then radiate out into space as infrared. However, as the energy passed through the shell it could be tapped by lining the inside with photoelectric cells, for example, or with green plants. Dyson further suggests that a portion of Jupiter's hydrogen could be converted to energy for the work needed to construct the sphere. The work itself might take several thousand years, though with the continually increasing powers of technology, it may be possible to complete the task in several hundred years.

From the outside, the shell would appear as a giant red star. (Several such stars have in fact been sighted by astronomers. These stars may be natural phenomena—but they may also be Dyson Spheres.) The inside surface of the Dyson Sphere will provide room for hundreds of trillions of people to live, and the Sun, now with all of its energy available, will provide the necessary energy for the activities of future civilizations. But there is, however, no reason to expect the situation to remain stable. I.S. Shklovskii, the Russian astronomer, and Carl Sagan, the American astronomer, who describe the Dyson Sphere in their book, *Intelligent Life in the Universe,* also go on to describe further possibilities in energy sources. If the rate of energy consumption increases to a point where not enough is received from the Sun, it may be possible to alter its nuclear reactions to speed up its energy output. At its current rate of output, the Sun is expected to last for several billion more years. Suppose, however, we are willing to cut that time in half in order to double the rate of output? That would still give us billions of years of power from our Sun before necessitating a move to another source. For instance, a large enough laser operating at gamma ray frequencies could be used to induce a controlled supernova state in the Sun, thereby extracting its energy far more quickly.

Once the Sun's energy has been consumed, we would, of course, want to move to the center of our galaxy (probably using black hole or worm hole rapid transit systems) where the stars are millions of times more densely packed than they are out on our spiral arm of the galaxy. At that point we would probably be dealing with the complex networks of civilizations which interact at our galaxy's center—but that's another issue. The problem here is energy for technological growth. At the center of the galaxy, the potential exists, according to British astrophysicist Geoffrey Burbridge, to start a controlled supernova chain reaction. At that point the energy will be available for some serious reengineering of the galaxy itself.

The Reconstruction of the Solar System Will Be Only the Beginning



Rick Sternbach's concept of a Dyson Sphere under construction: asteroidal rock is nudged into place by ion thrusters. The shell will not be perfectly ridged or smooth, but more likely a collection of bodies tied together by energy structures.

PHOTOS © 1978 UNITED ARTISTS

Jeff Goldblum, playing poet Jack Bellicec, witnesses the genesis of a "pod person." Following page, left: Leonard Nimoy, famous for his Mr Spock role, plays Dr. David Kibner in his first major movie. He's a psychiatrist who attempts to explain the invasion. Right: director Kaufman on the set of *Body Snatchers.*

By RICHARD MEYERS

Alien Re-invasion: The Body Snatchers Are Back

Director Phil Kaufman reflects on his remake of "Invasion of the Body Snatchers" . . . and the creation of sheer terror.

Philip Kaufman puts his hands behind his head, leans back in his chair and stares at the ceiling of his New York office. He remains silent for a few moments, formulating an explanation of his revolutionary new science-fiction film. Revolutionary because, in a world inundated with less-than-believable aliens, Kaufman's remake of the *Invasion of the Body Snatchers* is as serious as it is frightening.

"If *Close Encounters of the Third Kind* was a religious experience to some people . . ." he says slowly, "I mean, I sat next to people who thought they were in a hallowed place of worship—then I think fear is a religious feeling too, and a valid one. It can stimulate people to explore their ideas. I hate to even use the word religious, since this goes beyond religion as we know it. Wonder and awe are two terms that organized religions no longer seem to deal with. But science fiction deals with that fear—fear of a power greater than you and of ineffable, indescribable things."

The soul-searing horror of the new *Body Snatchers* arrives in the form of alien pod creatures capable of adapting their forms into almost any organic shape. "There's no real moral basis for why they've come," Kaufman explains. "It's really just what's set forth in Jack Finney's original novel. They leave a dying planet, they drift through space and they arrive here. Even though to us their invasion is an evil one, they're just surviving the best natural way they can." Unfortunately for Earthlings, these creatures' lifestyle consists of replicating humans exactly and co-opting their victim's consciousness while the person sleeps.

In order to give his bizarre vision of alien contact a realism and meaning for today's audiences, Kaufman had to call upon all his knowledge of film industry. Each technical aspect of *Body Snatchers* had to be planned in conjunction with every other, incorporating lighting tricks, riveting Dolby sound, affecting performances and a secret, surprise ending. But the first major obstacle to be circumvented was the overall cinematic technique for which director of photography Michael Chapman had two basic choices. He could film scenes realistically, allowing the horror to creep in almost unnoticed, or he could add an extra dimension of reality—purely technical clues of the terror to come.

What they settled for was an attempt to capture, in color, the horror of such black-and-white classics as Fritz Lang's *M* and Hitchcock's *Psycho* — the use of long shadows, dark doorways and other mechanical devices to create an overall ominous look.

Unfortunately, the filmmakers' choice only served to heighten the complexity of the project. "There were a lot of levels to this movie before we began," the director explains, "and even as we were making it, we discovered more. Sometimes I had to shut the set down so the entire cast and crew could have metaphysical 'pod problem' discussions. Things got extremely complicated as the lighting people and Chapman would have to take a scene apart. 'Well,' they'd say, 'if this guy is a pod over here, then I have a certain responsibility in filming him.'"

The camera's responsibility was to set up almost impossibly subtle filming angles to heighten the movie's theme; emotional relations that begin to change—quietly, at first, then with horrifying consequences.

The more obvious visual enhancements fell to the lighting crew under the direction of Chapman and Kaufman. It was all part of the director's master plan to make *Body Snatchers* a new landmark in the cinema of fear.

"The audience is being guided in different directions," he says. "There are stages along the way. You will see an evolution as people change. We went deeper into the evolution of that 'thing' coming from outer space and turning into a sleeping man. There are visual clues as to who is a pod and who isn't. There is 'pod lighting'—certain tinges of ultra-violet light, hardly noticeable at times—that plays off certain objects and people at different moments."

The production crew's preoccupation with details was not limited to just the visuals, however. Much thought, money and time went into the audio portion of *Body Snatchers* as well, leading Kaufman to make some avant-garde changes in the horror film tradition. Instead of mounting a lurid, sombre soundtrack in the tradition of Bernard Herrmann, the director sought out a composer and technical company more interested in his film than genre history.

"The score is by Denny Zeitman,"

(Continued on page 49)

"NOVA": Science to the People

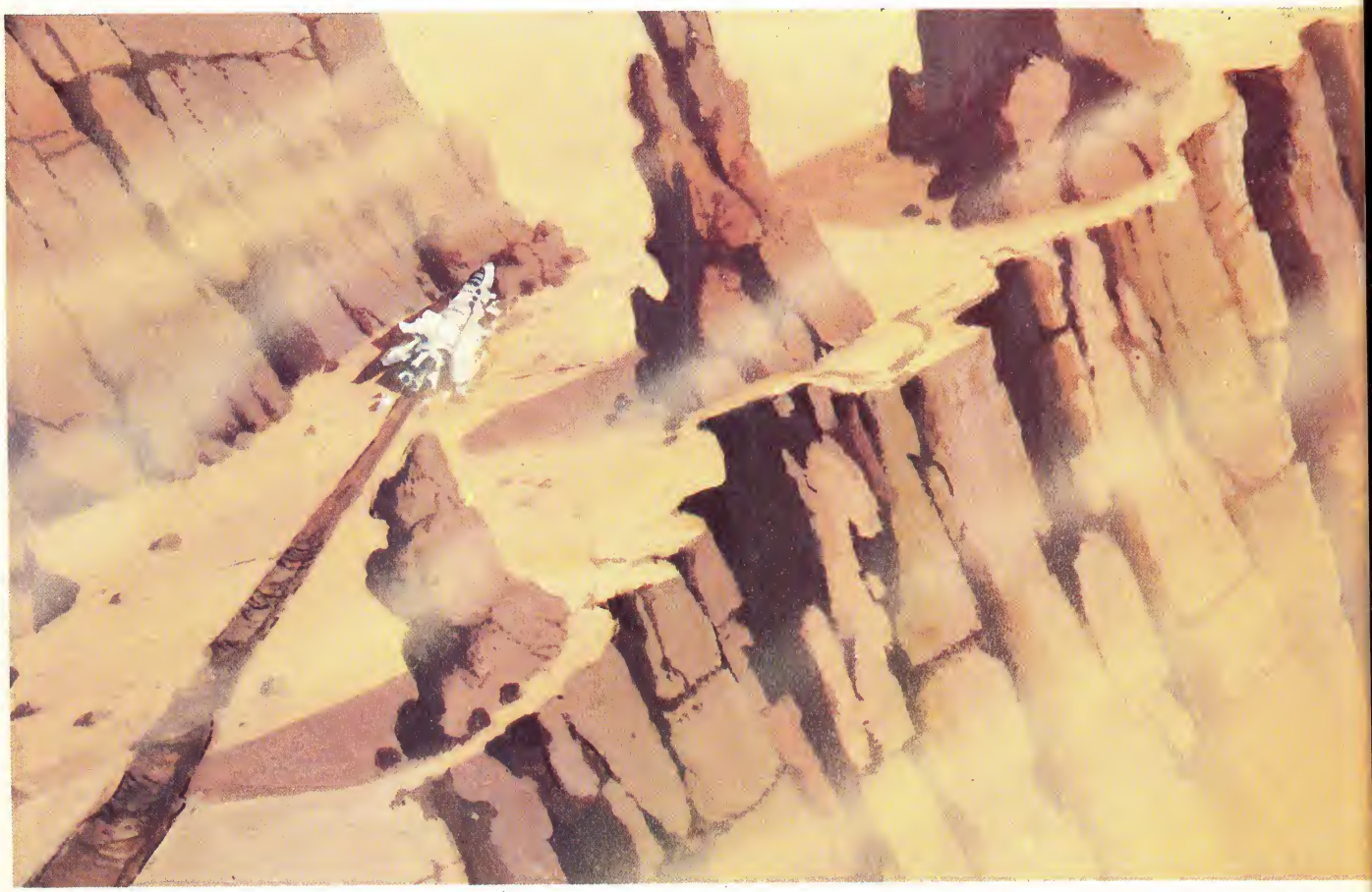
NOVA is the lone scientific oasis on television today. The winner of the George Foster Peabody Broadcasting Award, the American Psychological Foundation Grand Prix, an American Film Festival Blue Ribbon, two Ohio State Awards and the DuPont-Columbia University Citation for excellence in broadcasting, this PBS series is currently the *only* TV offering that regularly examines the ever-changing world of science.

Originating from Boston's WGBH-TV, *NOVA* will begin its sixth season in January and, under the guidance of producer John Angier, will offer viewers exciting glimpses of both natural sciences and futuristic trends in hardware and design. Among this seasons' first entries:

Black Tide: an engrossing episode detailing the lingering effects of an oil supertanker disaster. On the morning of March 16, 1978, the *Amoco Cadiz* went aground off the coast of Brittany sending 68 million gallons of oil surging into the sea . . . the largest oil spill in history. *Black Tide* traces the cleanup efforts, effects of the spill on the area's crucial tourism and fishing industries and the attempts of U.S. and French marine biologists to trace the passage of the oil through the threatened environment.

The Long Walk of Fred Young: tells the story of Dr. Frederick Young, a Navajo Indian who hunted barefoot and slept under the stars as a child. Today he is a nuclear physicist working on laser fusion at the Los Alamos Scientific Laboratory in New Mexico.

A World of Difference: gives viewers a detailed portrait of behavioral psychologist B. F. Skinner and his work. According to Skinner, environment alone controls behavior. Proving his point in the past, he has arranged experiments where a pigeon, with very little difficulty, was induced to peck continuously at a small disc ten thou-



UPCOMING SPECIALS

During the next twelve months, a number of science-fiction special presentations will be airing, some noteworthy, others routine. Among the most promising thus far announced are *The Martian Chronicles, Flash Gordon* and *The Clone.*

FLASH GORDON: Entire sequences of Filmation's ambitious two-hour animated telefilm, *Flash Gordon*, are finally coming together. The animated scenes have been in preparation for more than a year and a half. Originally scheduled for airing in the spring of 1979 on NBC, the air date has been pushed back to the fall, allowing animators more time for detail.

"I'm dying to get to the final editing," comments producer Don Christensen during a production lull. At present, the producer finds himself editing scenes for tightening. "But overall," he points out, "our big problem is that there's too *much* pace, too much action. There's the opening scene, the scene in Poland, the meteor

sand times while another was goaded into turning circles in his cage. Skinner's concepts of reinforcement, operant conditioning and behavior modifications are now part of textbook history, and so the psychologist has turned to more lofty goals ... setting up a human community, *Walden Two*, where men and women live the behaviorist life.

Cashing in on the Ocean: an exploration of riches under the sea. At the bottom of the northeast Pacific are billions of dollars worth of manganese nodules—hamburger-shaped lumps rich in nickel, copper, cobalt, manganese and iron. In a world of diminishing resources, these nodules are the subject of considerable attention. Who will farm these waterlogged riches, and which citizens of the globe will profit?

Hydrogen: examines the proposition that, as oil and natural gas supplies begin to run down, hydrogen could replace some of their functions. The theories, the experiments and the applications of the use of hydrogen for energy movement are detailed, including a look at the world's first proposed coal-powered airliner!

Also on hand for the new season will be such shows as: *Einstein*—a celebration of the 100th anniversary of the master scientist, showing Einstein the man as well as the thinker; *Fusion*—just what does nuclear fusion mean to humankind in terms of cheap energy?; *Memories from Eden*—once thought of as "prisons," zoos may now be the last refuge for wildlife; *Appropriate Technology*—India's new labor approach can be translated into "Small Is Beautiful"; and *Jari*—a billionaire attempts to take a stretch of Amazon jungle and turn it into a productive, rice-growing area.

The powers-that-be at PBS are extremely excited about the new *NOVA* season. Die-hard viewers will notice that, whereas last year's episodes had a very definite futuristic slant, this season's will deal with some critical problems in today's world and the application of science in terms of possible solutions. It's no accident that *NOVA* changes emphasis from season to season, show to show. The world of science is never stagnant, never dull. The same can be said for WGBH's *NOVA*.

Left: Zarkov's ship wrecked on Mongo.

bombardment, the plane crash, the escape in Zarkov's rocket, the voyage to Mongo (where we first really meet Dr. Zarkov), a missile attack by Ming's army, the crash-landing on Mongo, the battle between two huge monsters, the capture by the beast men ... and that all happens before the first commercial!"

In order to slow down the roller-coaster adventure somewhat, Christensen has recently begun adding montage sequences between explosive climaxes. The movie faithfully follows the comic strip exploits of spacefaring Flash, Zarkov and Dale Arden in their attempts to prevent Emperor Ming from taking over Earth. Set in pre-World War II times, the feature finds Ming in league with Adolf Hitler in his efforts.

"It's a great script by Sam Peeples," Christensen says, "but we've found it can lead us astray. What Peeples describes in a sentence or two can turn into a whole sequence, a *difficult* sequence to pull off at that.

Filmation hopes that this project, which has an unprecedented animation budget of $2.5 million, will open new doors for the company in the fields of SF and fantasy production. *Flash Gordon,* after airing on NBC in the states, will be released theatrically both in the U.S. and Europe.

THE CLONE: THE MAN WHO GAVE BIRTH TO HIMSELF is currently the working title of a CBS-TV movie scheduled for airing sometime during the winter months. This variation of the current clone fad concerns the plight of molecular biology professor, Dr. Corwin (Robert Forster), a man who is beside himself, literally, due to the nature of his work. Tolling with his mentor Professor Meredith (Ray Milland), Corwin is searching for the perfect method for human cloning. As the experiments progress, Corwin becomes less and less enthused with the idea. As a result of Corwin's indecision, Meredith takes matters into his own hands. Corwin soon discovers that, without his knowledge and/or approval, Meredith has actually cloned his assistant!

PHOTO 1978 CBS

Dr. Corwin (Robert Forster) beholds his clone twin in the lab of Prof. Meredith.

Corwin I meets Corwin II and decides to kill the clone ... until he realizes that the clone isn't such a bad sort, being an *exact* physical and mental duplicate of Corwin I. In effect, killing his own clone would add up to a sort of bizarre suicide for the young professor.

Written by John Shaner and Al Ramrus, *The Clone* is directed by Gus Trikonis, with Bob Banner serving as executive producer.

THE MARTIAN CHRONICLES is currently shaping up to be one of *the* most daring experiments in science fiction ever attempted on the tube. Starring Rock Hudson, Darren McGavin, Roddy McDowall, Barry Morse, Bernie Casey and Gayle Hunnicutt, the three-part miniseries will use about 90 percent of Ray Bradbury's original book's material ... which is a feat in itself.

Bradbury's work was a running narrative, tracing the first 27 years of humanity's colonization of Mars. Mixing science fiction and fantasy, Bradbury's *Chronicles* novel was, in actuality, a series of 26 vignettes — short stories that could stand on their own as separate works but were united via common backdrops and recurring characters. Richard Matheson's television adaption has managed to masterfully keep the same fragmented feel of the novel while adding a stronger narrative thread through the constant presences of Col. John Wilder (Rock Hudson), head of the Martian Expedition team and, eventually, Mars' most respected citizen.

Program one, *The Expeditions*, begins with a genial Ray Bradbury taking the viewer from 1976's actual Mars landing to January 1999's "Rocket Summer." The show uses material from the first third of the novel, from the story, "Rocket Summer," to the horrific tale of genocide, "—And the Moon be Still as Bright."

Episode two, *The Settlers*, begins with the short story of the same name and ends with the ambiguous alien contact tale, "The Martian." The final chapter, *The Martians*, portrays the end of Humanity on Earth and the beginning of Mars' human renaissance, incorporating the original novel's, "The Off Season," "The Watchers," "The Silent Towns," "The Long Years," "There Will Come Soft Rains" and "The Million-Year Picnic."

Co-produced by America's Charles Fries and U.K.'s Stonehenge Production, *The Martian Chronicles* could signal a return to literacy in televised SF.

EARTHSAT

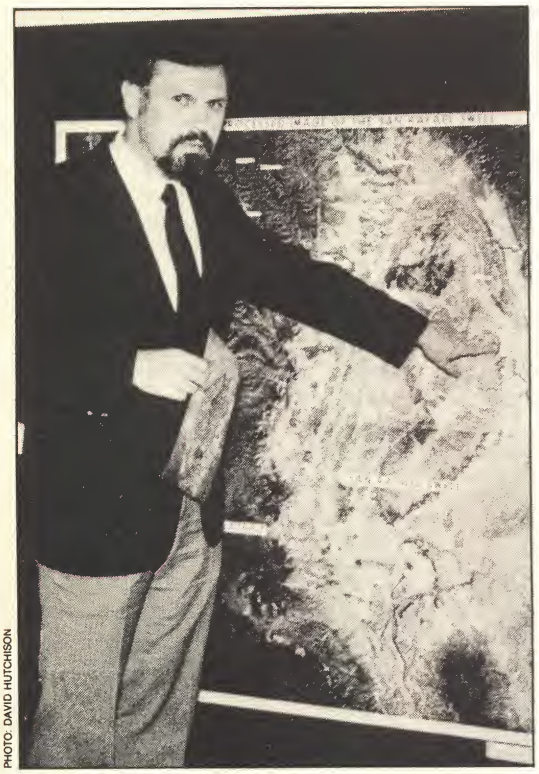


PHOTO: DAVID HUTCHISON

While NASA is busy refining the technology of satellites to look at the Earth, entrepreneurs are off and running—making space science pay off in planetary profits.

By ROBIN SNELSON

While most space industries await the arrival of the space shuttle, there are a few thriving enterprises already exploiting the natural resources of space. A small, high-powered industry has spun off from the National Aeronautics and Space Administration's Landsat program. Landsat is a multi-spectral scanning satellite which covers the entire surface of Earth (except some polar regions) every 18 days. Equipped with sensing instruments, Landsat relays continuous information about Earth's surface.

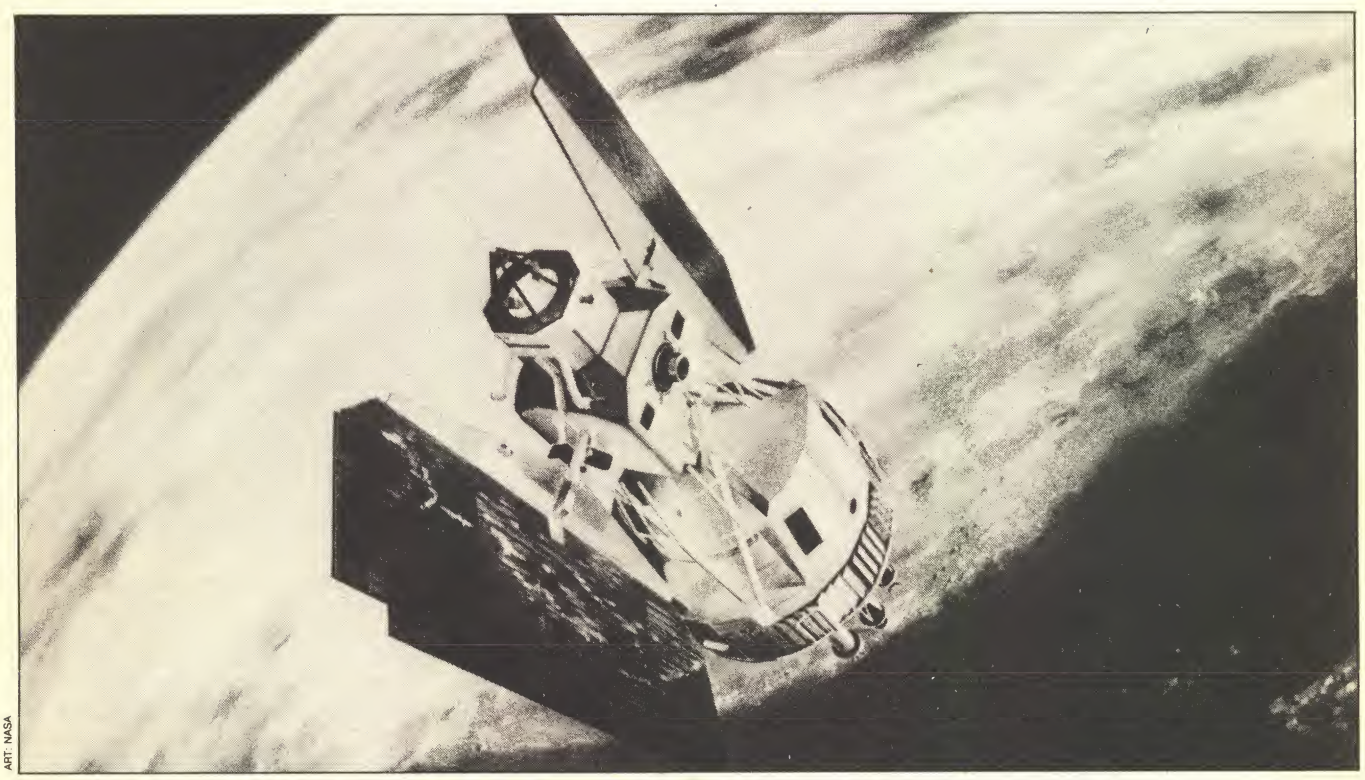
Early in the space age, it was realized that the "big picture" of Earth from space was a valuable natural resource. NASA began to explore the possibilities with the Earth Resources Technology Satellite program in 1968. Those early experiments only began to hint at the wealth of information that space technology could provide about our planet... information that could help monitor the environment, locate oil and gas reserves, prospect for mineral deposits, search for water sources, survey for crop disease, manage land resources...

From the outset, plenty of planetary business firms saw potential in the new technology. Oil companies wanted to look for promising geological formations, farmers and foresters were interested in the big picture of erosion patterns and clear-cutting, and commodities brokers smelled profit coming from advance information on crop yields.

And from the beginning, Earthbound entrepreneurs were discovering how to make money by analyzing the wealth of data suddenly flowing from NASA's remote sensing satellites.

One of the first companies to spring up around the new space technology—and the leader in the field today—is Earth Satellite Corporation. EarthSat president Robert Porter headed NASA's Earth resources program from 1965 until 1969. He founded EarthSat in 1969, to make use of NASA remote sensing technology to do natural resources development. Today EarthSat has numerous commercial and government customers, plus interests in oil and gas exploration programs.

EarthSat is also recognized as an inno-



ART: NASA

Above: NASA painting depicting Landsat in Earth orbit. Landsat covers the surface of the Earth every 18 days. Opposite page: Earth Satellite Corp.'s vice president Charles Sheffield with an originally enhanced Landsat image.

vator in the relatively new science of extracting useful information from Landsat data. EarthSat vice president Charles Sheffield is one of the scientists responsible for major contributions to the growing store of knowledge about how to best use Landsat data—via computer enhancement of the images. But Sheffield is the first to point out that the multi-colored images are far from obsoleting conventional methods of information gathering.

"It's still a new tool," Sheffield says. "The program is just over six years old. The first Landsat went up in 1972. All these things we're doing now are kind of groping around. Maybe in a year or two we'll be smarter than we are now."

Scientists and entrepreneurs alike are still in the process of defining Landsat's value. "There is no magic interpretation of Landsat images," Sheffield explains. "A lot of collateral information goes into our analyses. We just find out how valuable the satellite data is when it's used with other information."

So Earth Satellite Corporation's roster lists engineers and scientists drawn from the fields of geology, mining, forestry, agriculture, oceanography, hydrology, geography, geodesy and mapping, biology, urban and regional planning, economics and more.

"We have a mixture of people who like to work with people who know a lot about some other field," Sheffield observes. "It's stimulating and we rub off on each other. . . I can make meteorological noises and Earl Merritt (head of the food resources group) can talk computers and John Everett (chief geologist) can talk about Eigen pictures (see page 37)... generally there's a lot of cross-transfer of information going on."

That easy cross-transfer of information is one of the factors that makes EarthSat so effective.

In addition to selling computer-enhanced Landsat images, EarthSat sells the imformation that goes along with the pictures. Teams of specialists within the company analyze the images and combine information derived from the pictures with field studies, weather data and other information sources to arrive at conclusions for their customers.

"One of our pictures costs about $1,300," Sheffield says, "but to derive the information contained in one picture may cost well over $50,000."

At EarthSat, the Landsat technology is only part of the process. "There have been conflicting statements about whether or not Landsat can be used for geological prospecting," Sheffield remarks. "The actual truth is that you cannot use Landsat *alone* for prospecting, but we know it can be a very valuable additional tool."

According to David Thibault, head of EarthSat's Energy and Environment group, the big picture from space is particularly precious in parts of the world where very little other information is available. "The great value of this technology can especially be seen in developing countries, where data are scarce and reliable maps don't exist," Thibault says. For ex-

Wally Schirra and partner, Ira Bechtold.

Wally Schirra: Down to Earth

By DAVID HOUSTON

Former astronaut Wally Schirra is one entrepreneur in the Landsat business, as director of Bechtold Satellite Technology Corp. (BESTEC), a southern California company which analyzes Landsat data for commercial and government customers. From his vantage point during his astronaut career—piloting Mercury, Gemini and Apollo spacecraft—Schirra was naturally one of the first to realize the value of looking at Earth from space.

"I saw some shots that John Glenn and Scott Carpenter took with a dinky little 35mm camera back in 1962," Schirra recalls. "I said, 'This is ridiculous!' So not really knowing what I was starting, I went to the best photographers I knew, from *Life* Magazine and *National Geographic*. They said the Hasselblad is the best camera because of its 70mm format.

"The camera I took into space was worth about $20,000—but that was nothing compared to what we came back with!"

In his current profession, Schirra finds himself continually reemphasizing how much value can be obtained from data returned from satellites in space. But as Schirra's partner, Ira Bechtold, co-founder of BESTEC, points out, it isn't easy to convince customers that this new technology is reliable. "It's just hard to sell people on a new approach," Bechtold admits. "An oil company paid us $5,000 for a survey of an area. Then they went out and paid $100,000 for a seismic survey to check out our results!" The high-priced, ground-based survey bore out BESTEC's findings, and Bechtold says the satellite survey contained more information.

While Wally Schirra was taking pictures in space, Ira Bechtold was back on Earth acting as a consultant to major industrial concerns engaged in petroleum exploration and geophysical studies. He was involved with NASA, buying and using space imagery, and he served as a principal investigator on the Skylab and early Landsat projects. From the earliest space missions and the photographs the astronauts brought back, Bechtold saw the profit-making possibilities in space imagery. In 1974, Bechtold and Schirra founded BESTEC to capitalize on the enormous amount of data available from NASA.

Long before the first Landsat was launched, Schirra felt that the "big picture" of Earth from the perspective of space promised to be a valuable tool for the future.

"It got boring up there in orbit," Schirra says. "Sixteen sunsets and sunrises in 24 hours. You look out the window and there's the Earth. You can't help thinking: How can we use it? How can we best use the resources and take care of it?"

Those experiences turned Schirra into an environmentalist—with a twist. "Too often we hear people talking about preserving a piece of land *in perpetuity*. That's a terribly narrow attitude. I'm on an advisory board for the national parks, and they love to use that expression—*in perpetuity*. I don't even like the word 'conservation' anymore. The question ought to be: How do we use what we have efficiently? You can't 'conserve' energy without *using* it. If you use it, then you can talk about how *well* you use it."

Schirra thinks Landsat can help us use our resources intelligently. "The Landsat program has made people aware of the fact that we can look back on our Spaceship Earth, log in what we have and put that to use practically.

"Landsat hasn't gone as far as I'd like to see it go," Schirra admits. "Right now it's more of a technical gee-whiz doodlebook world. But I think that eventually Landsat and other remote sensing satellites of the future can teach us to take advantage of the resources we have on this planet—geology, the oceans, civilization centers, communications systems—and bring it all into a working package."

Schirra's space-borne experience made him optimistic about the future on this planet. "You know, neither Landsat nor the astronauts could ever find the county lines, state borders or national boundaries on Earth. They only put them on maps. They aren't painted on the real world."

ample, the north African country of Libya will be the first nation in the world to have a digital Landsat national map series. The computer-enhanced mosaic maps are being produced for the Libyan government by EarthSat.

Some of the company's other ambitious projects have included radar mapping of the Amazon region for the government of Brazil, land use inventories and planning for the governments of Venezuela, Ecuador, Guatemala and Iran, and mineral exploration, timber inventories and agricultural planning for the president of Zaire. Much of EarthSat's business to date has been involved with assessing the merits of Landsat technology for foreign administrations, U.S. government agencies, states and private corporations.

"It's still a very tough market, because it's a new technology," Sheffield points out. "You spend two-thirds of your time with a prospective client educating and explaining what the technology is."

Without question, EarthSat and other early-bird enterprises in the Landsat business have a healthy start in the infant space industry. "Actually, now would be a good time for a company like ours to start up," Sheffield observes. "We just jumped in early. It's a risky business, but there's a jackpot potential."

Another factor which makes the Landsat imaging and analysis business tough: There is no guarantee that there will always be Earth resources satellites in orbit, gathering information. Landsat is still defined as a developmental NASA program. Sheffield explains the problem: "The Landsat system is not what NASA calls 'operational' yet. When NASA undertakes a program, it must be developmental. When a program goes operational, it leaves NASA and goes to another agency—Department of Agriculture, Department of the Interior, National Oceanic and Atmospheric Agency—or in the single case of Comsat (Communications Satellite Corp.), a NASA program spun off to become a commercial venture. Until the program becomes operational, there is no guarantee that you'll always have a satellite and continuous coverage.

"So the problem is that some potential users of the technology are reluctant to build a data source into their operation unless there is a guaranteed source of information."

Sheffield, like others in the Landsat business, is eager for the program to go operational.

"My own preference would be one of two ways," Sheffield says. "Either define some agency—it doesn't matter which one—as the operational agency for Landsat. The other option is for the government to say it's well enough established for Landsat to follow the Comsat lead and go into the private domain."

(President Carter's recently announced space policy disappointed the Landsat business community. Carter's space policy group recommended that Landsat

IMAGE BY EARTH SATELLITE CORP.

This scene of Peru shows the rapid descent from the Andes Mountains to the coastal plain. On the left of the image, about midway up, is the "space landing strip" Von Daniken talks about. It shows up as a white line against blue background. Of more interest to EarthSat: the amazing drainage patterns from mountains to plains.

stay exactly where it is—a NASA developmental project—until 1985. Experts speculate that the President's decision had more to do with national security matters than with the state of the art of Landsat technology.)

The outlook for the future of Landsat technology is optimistic. In the early 1980s, there could be two or more satellites in operation—with better spectral resolution than the current model. Landsat 3, launched last spring, has a resolution of approximately 70 meters—meaning that's how large an area shows up in one point (or pixel) of a Landsat image. Sheffield believes EarthSat can get an effective resolution of 50 meters with computer enhancement, and he notes that the trained human eye can distinguish features below the resolution limits (such as a 20-meter road) by inference—by connecting visual patterns around a feature, the trained eye can make out smaller details. In less than 15 years, Landsat should be able to provide a resolution of five to ten meters. The limiting factor is not technology, but international politics. Currently, only military satellites are capable of that kind of resolution.

Along with better resolution, computers will play a larger role. EarthSat's Energy and Environment head, David Thibault, speculates: "Maybe five years in the future, computers will be able to do some of the classification that is done by people now. There has been a lot of research in this country on how to classify crops using the multi-spectral data from Landsat; everything has its own unique multi-spectral 'signature.' As more and more of those signatures are classified, by matching ground-based data with satellite signals, identification will be able to happen right at the satellite.

"The dramatic impact of that advance," explains Thibault, "will be that an area which may take a year and a half to analyze by today's standards, would take only a matter of days once the satellite can analyze the multi-spectral signature."

Sheffield takes that a step further, predicting that Landsat will someday become an indispensable global monitoring tool.

"The way I see Landsat being used ultimately is as a way of updating our inventory as to what's going on on the surface of Earth. We'll just keep doing it and getting better at it. We'll always have Landsats. It will become a very inexpensive instrument for detecting changes on the surface of the planet...man-made (changes), such as environmental degradation, or natural causes, like forest fires or tidal waves. It will become a basic monitoring tool.

"It will become computerized to such an extent that change detection will be able to be done on the computer. Presently, if we're looking for the effects of strip mining, we have to compare 'before' and 'after' images and then do a change detection to see what effect it has had on the environment.

"Landsat could become completely automated," Sheffield speculates, "constantly updating and comparing images on the computer. Then the computer would only report significant changes for human inspection. That's the ultimate."

But even in its technological infancy, Landsat is proving its worth to resource-minded enterprises on Earth.

"Name a major oil company and we've probably done work for them," Sheffield says. Indeed, Earth Satellite Corporation estimates the company has located $1 billion in oil and gas reserves and $100 million more in mineral deposits. "When you make a substantial geological find, the cost of remote sensing analysis becomes negligible."

With the arrival of the space shuttle era, Landsat is likely to become a booming business. More sophisticated satellites and improved access to the flow of data promise to broaden the horizons of Landsat—increasing the potential and applications of space technology for taking care of planet Earth.

(more—►)

This pair of images shows the effect of a different kind of computer processing. On this page is the standard product which has been enhanced for contrast and detection of edges. On the opposite page is an eigen picture, in which the same scene has been subjected to a special process in the computer to maximize the amount of scene information that can be represented in the form of a color image. Shown is the San Rafael Swell of Utah. Salt Lake City is a hundred miles to the northwest. The area is important for oil exploration and is a test site for EarthSat's work in uranium prospecting techniques.

IMAGES BY EARTH SATELLITE CORP

If you have an incurable urge to gaze at more Landsat images, *Mission to Earth: Landsat Views the World* is a handsome, large-format NASA book with 400 color plates. It was published in 1976, so in the Bicentennial spirit, 150 of the images are of the United States, with at least a part of all the 50 states pictured. The remaining 250 images span the globe, and 35 more illustrations are included in the informative introductory chapters. *Mission to Earth* may be purchased for $14 from the Superintendent of Documents, Govt. Printing Office, Washington, D.C. 20402. Order by stock number: 033-000-0659-4.

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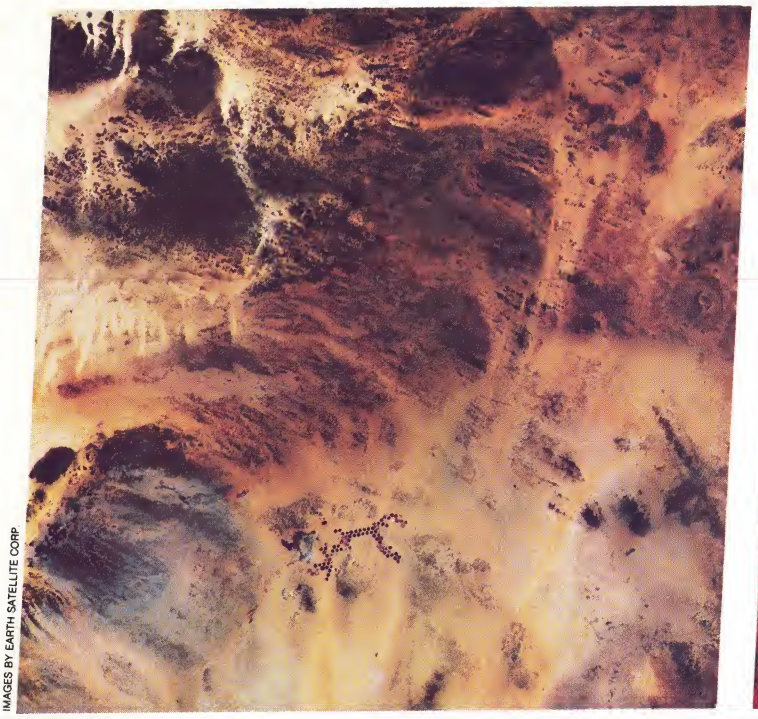
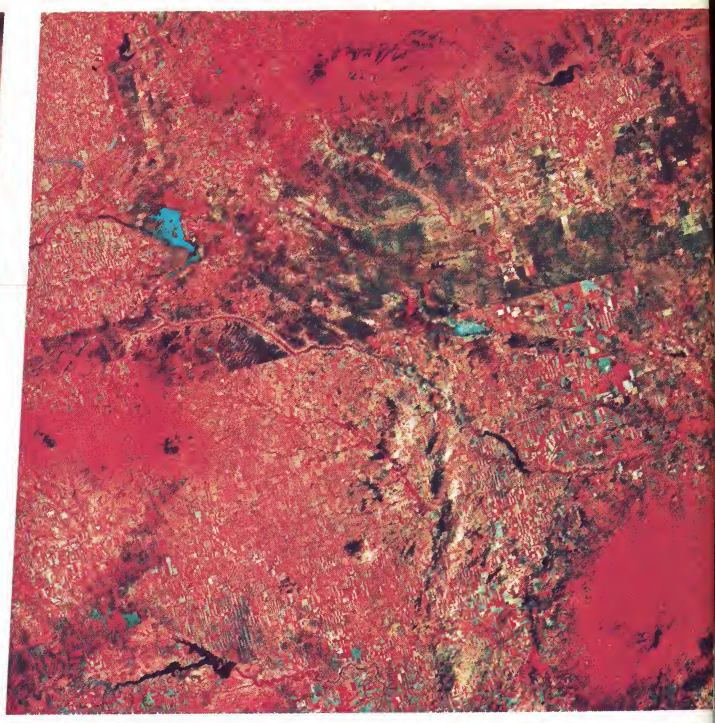


IMAGES BY EARTH SATELLITE CORP

Part of a photo map series EarthSat is making for Libya. The pattern of irrigated fields at bottom of image is Kufra, where fossil water from a deep-lying aquifer is being used to provide the only fertile spot in the scene. The center-pivot irrigation accounts for circular areas of growth.



The international boundary between Canada and northern Montana is clearly revealed on this image by the difference in intensity of agriculture. The characteristic strip pattern of farming, more intensive in the U.S., prevents soil loss in areas where there is danger of wind erosion.

How EarthSat Makes Pictures from Satellite Signals

Landsat orbits Earth at an altitude of 917 kilometers (570 miles). It returns to the same spot above Earth every 18 days, continuously scanning the surface with its multi-spectral scanner. The spacecraft does not take pictures in the usual sense; instead, it supplies images in digital points or pixels (picture elements), and according to spectral wave-lengths, not "colors" as they are perceived by the human eye.

The pixels transmitted from the spacecraft are recorded on magnetic tape at the Earth receiving station. Each pixel corresponds to an area of land approximately 57 meters by 79 meters. The standard Landsat image contains about seven and half million pixels.

"The easiest way to think of it," explains EarthSat's Charles Sheffield, "is that Landsat is sending back four streams of data. One picture is taken with a green filter, one with a red filter, and the other two streams of data are in the infrared—just beyond the visible spectrum."

The digital information from the four spectral bands can then be translated into four black-and-white pictures. But those black-and-white pictures may contain up to 256 different shades of gray. The naked eye cannot distinguish nearly that many gray levels, so the information must be color coded before the images can be interpreted.

"If you want a picture for a particular purpose," Sheffield explains, "you should do all the manipulations on the computer to enhance the information you're looking for *before* you make the picture."

So, before going to the photographic process, EarthSat's scientists modify the data —NASA's digital tapes—with their own computer-enhancement techniques. (Many companies in the Landsat-analysis business simply buy black-and-white photographic plates from NASA, then manipulate the color coding. EarthSat prefers to go back as close to the original source as possible, so they buy raw data from NASA.)

"You can buy the pictures from the government for $30 or $40," Sheffield remarks, "but because it's mass-produced, it's probably third or fourth generation photographically. And because it's not specially processed, people are willing to pay the $1,300 we charge for specially processed images—because it will have the information content they want."

Once EarthSat's computer experts have refined the software, the magnetic tapes go to the photo lab.

Jerry Noss, head of EarthSat's photo lab, explains how digital data becomes a color image: "The first job is to transfer the digital data stored on those magnetic tapes to a piece of photographic film. The tape is played back on a tape drive and relayed to film held in what amounts to a glorified box camera. Light-emitting diodes—pin point light sources—respond to the digital input from the tape and create density spots on the film.

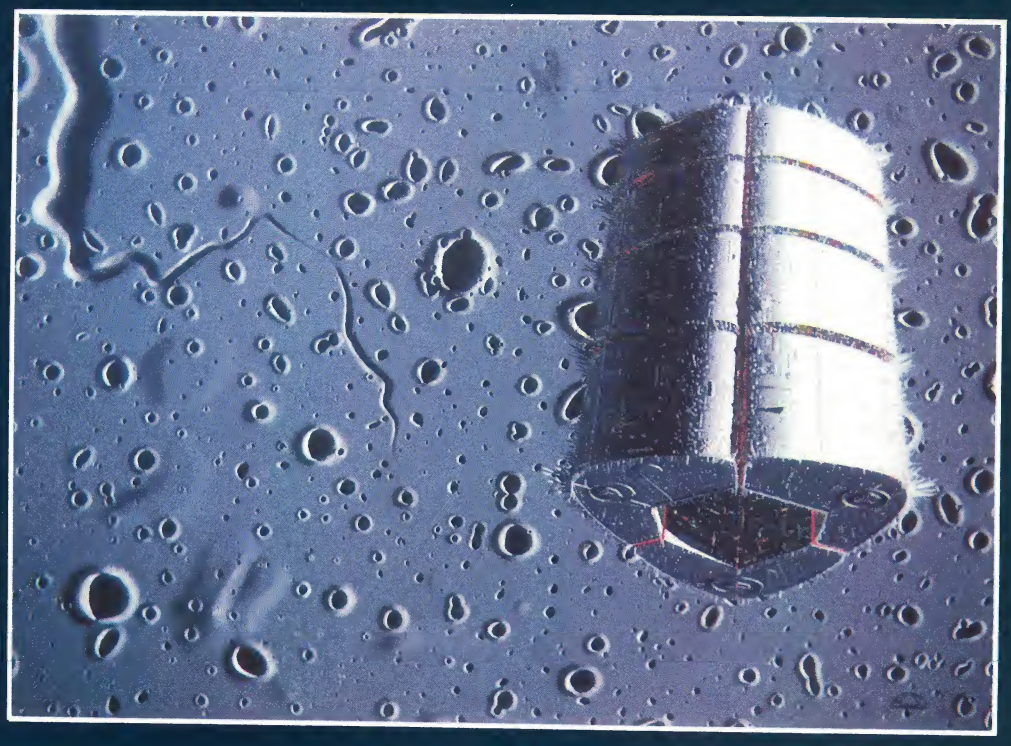
"So the data is converted to four separate black-and-white pictures, one for each spectral band. Each black-and-white image is composed of seven and a half million picture elements.

"The next thing we do is register the black-and-white images from each spectral band with each other. Then we put the black-and-white positives, one at a time, on a vacuum frame and expose a piece of color film, sequentially, through three primary additive filters: red, green and blue.

"Like all color-additive systems, the appropriate combination of these three colors gives us a full-color spectrum display. We then take the color negative, process it and print it."

Of course, the color combinations in the final product are up to the discretion of the computer enhancer. Depending on the imaging process being used, the picture may be a conventionally coded NASA picture where red means vegetation...or a lurid tutti-frutti like EarthSat's specialized eigen pictures. Who knows what opportunities this practical science may offer spaceborne landscape artists of the future?

Adolf Schaller



ART © 1978 ADOLPH SCHALLER

This issue's "Future Gallery" focuses on the stunning extraterrestrial visions of Adolf Schaller, a 22-year-old artist who kindles his imagination by reading volumes of scientific papers and journals—along with healthy doses of science fiction. "I like to think that science and science fiction—and what I do—all have the same goal," Schaller says: "better understanding the universe we live in."

One of the eight artists chosen for FUTURE's Space Art Club, Schaller's work has also appeared in *Astronomy* magazine and in National Geographic's *Amazing Universe*. One of his current projects is doing paintings for Carl Sagan's upcoming PBS series.

On this page, one of Schaller's early speculations on a possible destiny for a spacefaring scientific and technological society—possibly ours. Painted in 1972, when he was 16, Schaller considers this work to be a "major turning point in my evolution as an artist." It is the first example of his concept of an "intelligent interstellar organism" (the object on the right).

"I define 'organism' as any closed organized system which has the capability to evolve into a more complex organized system," Schaller explains. "Just as we are made up of basic units called cells—and therefore are referred to as multi-cellular organisms—so is this large organism made up of smaller modules, and can be referred to as a 'multi-modular organism.'

"The analogy can be extended to include the DNA in cells (information carriers) which corresponds to *us* inside the modules of this ship. This organism exists in interstellar space and uses the raw materials to be found there: energy as well as mass."

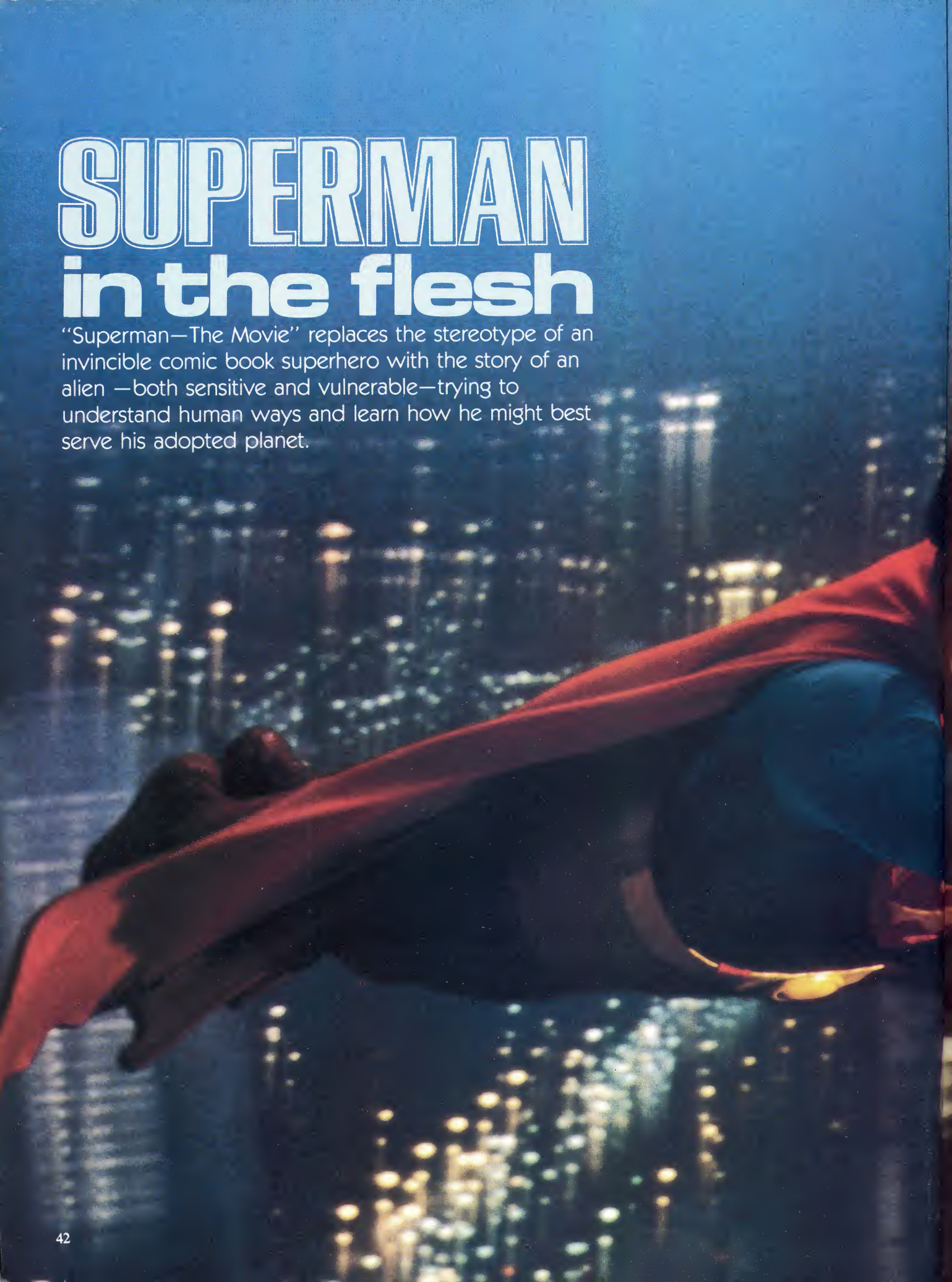
On the following centerspread, a recent Schaller creation takes us inside a nebula. The artist describes his vision: "The view is from inside a stellar birthplace, as seen from high in the atmosphere of an Earth-like planet, about 4.6 billion years old, with two moons. The time is just before dawn. The planet and its solar system are passing through a nebula, becoming witness to numerous comets and collisions with meteors."

Schaller calls the painting, "A Lamentation for the Vacant Skies of Terra."

Centerspread: "A Lamentation for the Vacant Skies of Terra." ©1978 by Adolf Schaller. →

SUPERMAN
in the flesh

"Superman—The Movie" replaces the stereotype of an invincible comic book superhero with the story of an alien —both sensitive and vulnerable—trying to understand human ways and learn how he might best serve his adopted planet.



By HOWARD ZIMMERMAN & ROSCOE POUND

Superman is a 20th-century legend. Over the years he has been seen by generations of children and adults as a larger-than-life hero in newspaper strips, comic books, cartoons, movies and on TV. Everyone knows that Superman is an all-powerful alien who is dedicated to stamping out evil, saving lives and promoting truth, justice and the American way.

Now along comes *Superman—The Movie*, a $50-million-plus production based on this familiar comic book creation. But this time around there is a difference. Here Superman is not treated as a one-dimensional character—a preposterous caricature of total invincibility. For once, Superman is human . . . that is, he is portrayed as an alien who adopts Earth as his home planet and dedicates himself to becoming human.

But director Richard Donner also wanted to capture on film the full scope of the 40-year-old legend. So the movie features an exploding planet, Superman catching a 747 in mid-air, space travel, dimensional travel, the frozen Fortress of Solitude, Kryptonian criminals from the Phantom Zone and the whole cast of supporting characters—including the supervillain Lex Luthor and his bizarre bag of evil tricks.

Donner had to walk a fine line to combine these two seemingly independent elements—superhero spectacle and human-interest drama. His approach was to always have his focus on the *people*.

"The film has humanity in it," Donner says. "It has real people in it, totally. I said to myself when I started this project, 'They're larger than life, but in their own world they must have reality!' "

Donner's insistence on the integrity and verisimilitude of his comic book world-come-alive carries through every scene, right from the opening shots on Krypton, Superman's home planet. "To me," Donner says, "Krypton is a fantasy. It has such little reality to us all because outer space has such little reality. And yet it has its own reality with Marlon Brando and Susannah York (Superman's parents). It has a distinct reality even though it's science fiction and it's 'out there' in space." Donner credits his actors with making Krypton live. "They're so rich in it and play it so well."

In the midst of all the spectacle and drama, Donner has provided ample comic

Christopher Reeve, as The Man of Steel, proves himself worthy of the name. When a disaster causes a railway line to break, he replaces the track with his body so a speeding train does not crash.

relief. Much of it arrives in the form of Lex Luthor and his band of outlandish and incompetent evildoers. Still, Donner does not go all the way. "Lex Luthor *is* Lex Luthor," he says. But "he is real within his own realm. Gene (Hackman) is playing it very straight. He has his moments though—he's a larger-than-life character."

Sometimes the challenge of keeping the story from going over the edge of reality into pure comic fantasy was too great. But when it did happen, Donner says, "We had to go right back and make it honest. We had to make it as real as we could within that framework....It's still bigger than life, but hopefully it's *there*."

Helping Donner to stay on target is actor Christopher Reeve, who turns in the first serious screen portrayal of the alien Superman and his all-too-human alter ego, Clark Kent.

Reeve was well aware of the fact that people have been following the continuing legend of Superman for the past 40 years. In order to remain as faithful as possible to the familiar image, he sought the advice of the experts—the people who write the *Superman* stories at DC Comics in New York City. He was pleasantly surprised.

"They said to me, 'The most essential thing for you to remember about Superman is that he is an orphan—think about the vulnerability that that implies.' "

That's a good starting point for planning a characterization of Superman, but what about his well-known secret identity, Clark Kent? Reeve discussed this too with the people at DC. They were in complete agreement with his desire to create a fully formed, human character with all of the problems and complexities that go along with being human. DC exec Sol Harrison gave him free reign: "Please do something with him. Go on and flesh him out."

But Reeve says that the Superman seen onscreen is "the same person everyone's seen in the magazine. I'm not going off on a tangent someplace...we're being inventive without going overboard." (And DC obviously agreed. They had full control of the final print and did not make a single change.)

Part of the invention was necessary to give Superman a reason for being here in the first place. Says Reeve, "The reason for his existence on Earth is covered in the movie. It never really has been before. The whole reason for his mission on Earth—he was *sent* here—is laid out."

(continued on page 66)

The Gift of Flight

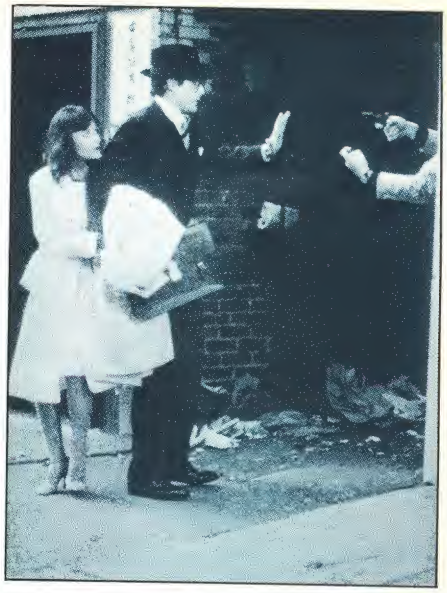
This Christmas, so the advertising copy goes, "*Superman* is bringing you the gift of flight." Superman soars across the sky from behind buildings and bridges and even does aerial battle (in Part II) with three super villains above the skyline of New York. The credit for these startling sequences of a human in flight goes to quite a number of people and the technology and techniques that they evolved.

Making Superman fly was a two-pronged problem: (1) how to do it, and (2) how to make the trick undetectable. The usual choice for some sort of flying sequence is the blue-screen traveling matte. But wait! Superman's famous costume is only a shade of blue away from the blue-screen background. Under normal matting procedure all we would see in the final composite is a red cape and boots flying through the air!

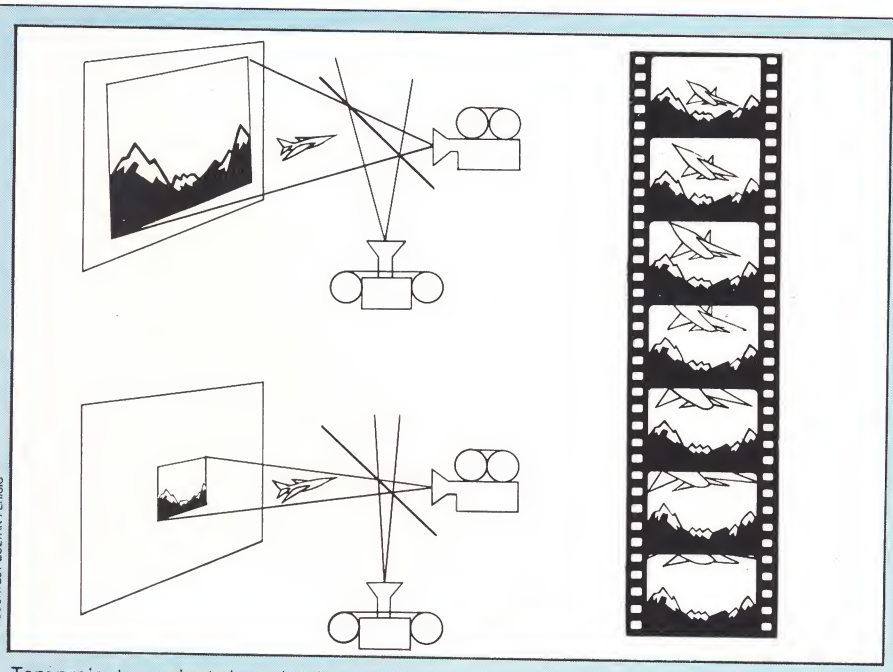
Use of the sodium-vapor process would have solved this problem, but unfortunately for Roy Field, head of the *Superman* optical department, the only sodium-vapor equipment was in Burbank, California, under license to Disney Studios.

And so began a long and tedious process of generating "color difference" mattes. With the generous assistance of Kodak, the precise difference between the Superman blue and the blue screen was

PHOTOS © 1978 DC COMICS



Above: in his Clark Kent persona, Superman would rather yield to a Chinatown mugger's demands than fight. Top left: Superbaby pays early dividends to his adoptive parents, Ma and Pa Kent, as he eliminates the hard part of changing a tire. This scene is right out of the comic book legend. Opposite: Superman and Lois Lane find that despite their different backgrounds they still have things in common. But Superman is still frustrated by Lois' lowly opinion of his human alter-ego.



ART: COURTESY ZOLTAN PERISIC

Top: projector projects large background with zoom lens at widest focal length.
Bottom: projector projects small background with lens zoomed to longer focal length.

plotted out and the necessary high-contrast mattes or masks were generated. (STARLOG magazine is preparing an article describing all the various traveling matte systems as part of its Special Effects series.)

An alternative to blue-screen traveling matte is front projection. This system, which is self-matting and allows the cameraman and director to see the finished composite in the viewfinder, has seen quite a bit of use in such famous films as *2001, Silent Running* and *CE3K*. Generally speaking, front projection does not have the freedom of movement that the blue-screen traveling matte allows the camera, so shots tend to appear static with only limited pans, etc. In a film like *Superman,* in which movement is everything, front projection would be too limiting. On the other hand, generation of color difference mattes is costly, time consuming and the final composite cannot be seen until the entire lengthy laboratory process is completed—and, of course, it is then too late to make changes if the shot is unsatisfactory.

This seemingly insuperable barrier to the Superman flying sequences was knocked flat by inventor Zoltan Perisic with a revolutionary improvement to the front projection process, the Zoptic. "The Zoptic special-effects device enables the subject to appear to move 'in depth,' says inventor Perisic, "while its real position relative to the camera remains unchanged." It then becomes possible to portray a spaceship (or Superman) as though it were flying towards the camera, while the back projection shot remains static.

Mr. Perisic, who is the author of several books on animation, a filmmaker and inventor, worked on *2001* with Stanley Kubrick and has been developing his patented invention for some years. It was not until *Superman,* however, and Richard Donner's enthusiastic drive for perfection that a showcase for the Zoptic device came about.

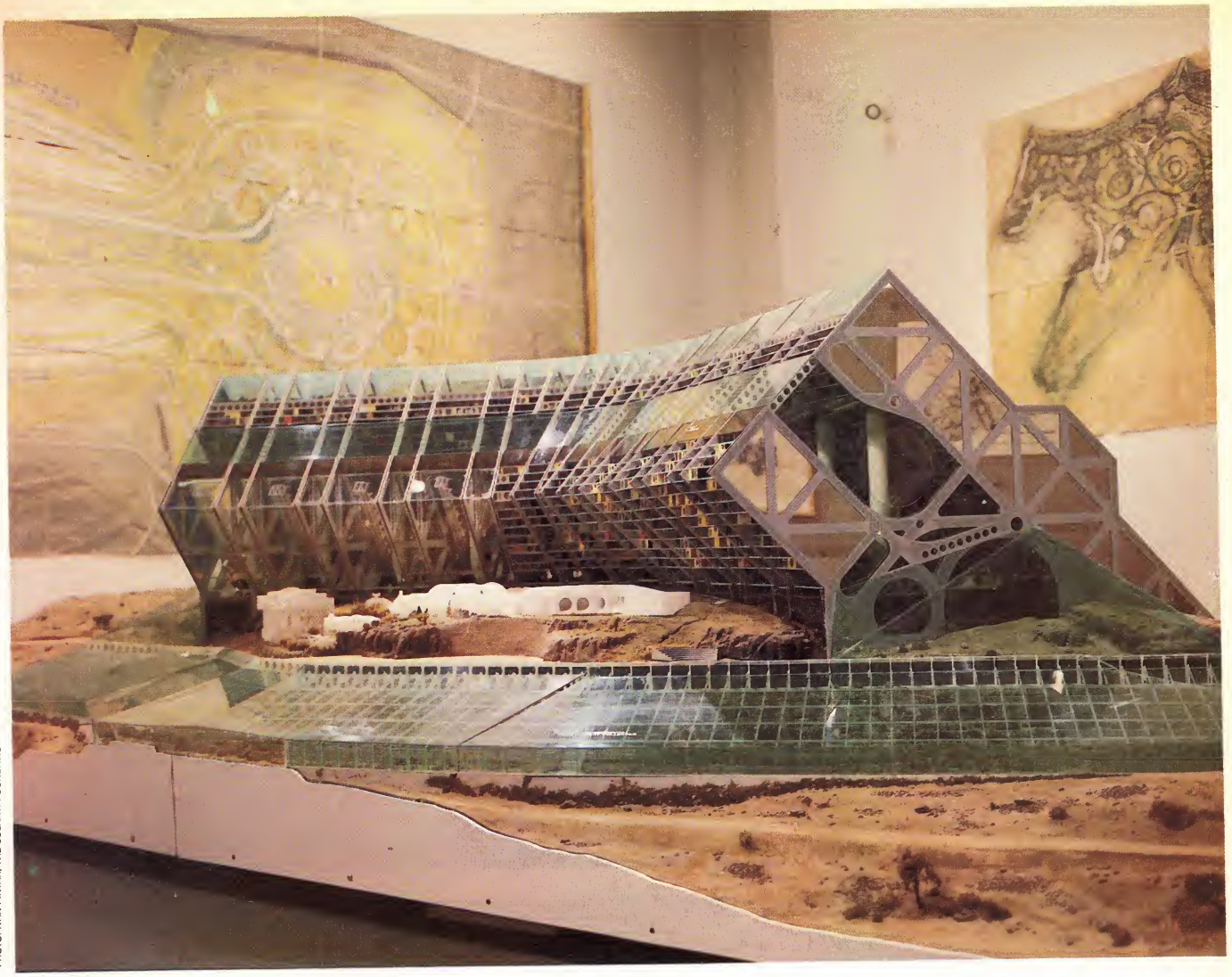


PHOTO: IVAN PINTAR, THE COSANTI FOUNDATION

Arcosanti: A City of the Future

Paolo Soleri builds a living model of his community of tomorrow in the Arizona desert.

PHOTO: DAVID WING

Above: architect-philosopher Paolo Soleri. Top of page: detailed scale model of Arcosanti, a prototype town for 5,000 being built to test Soleri's concept of an arcology—a blending of architecture and ecology to solve urban crises.

By MICHAEL CASSUTT

On the edge of an arroyo an hour's drive north of Phoenix, Arizona, stands a tight group of alien structures—sweeping arches, brightly-colored domes, a building seemingly made of boxes piled on boxes. The road from the freeway is poor, the nearby town is little more than a couple of gas stations and a few weathered houses. Is this the private home of some wealthy eccentric? Maybe it's a real-life "Devil's Tower Base" awaiting the arrival of some Mothership.

It's called Arcosanti, and it is a true rarity, the dream of one man turning into reality. The man is the architect, sculptor and philosopher Paolo Soleri.

When finished, fifteen or so years from now, Arcosanti will house five thousand people, all of them, in effect, living in a single huge building, with shops, schools, playgrounds and apartments all within walking distance of each other. No cars, no freeways, no smog.

Arcosanti might just be the city of our future.

At 59, Paolo Soleri has captured worldwide attention with his concept of "arcology"—the marriage of architecture and ecology. Or, as the title of one of Soleri's books has it, building cities "in the image of man."

Soleri was born in Turin, Italy, and studied architecture at the city's polytechnical institute. Following World War II he came to the United States to study as an apprentice to the famed architect, Frank Lloyd Wright, at Taliesin West, Wright's home and workshop outside of Phoenix. But Soleri found the role of disciple a difficult one. Wright aimed at creating single buildings, while Soleri was already beginning to be concerned with the creation of total cities. In 1949 he went on his own.

He was an innovative architect, design-

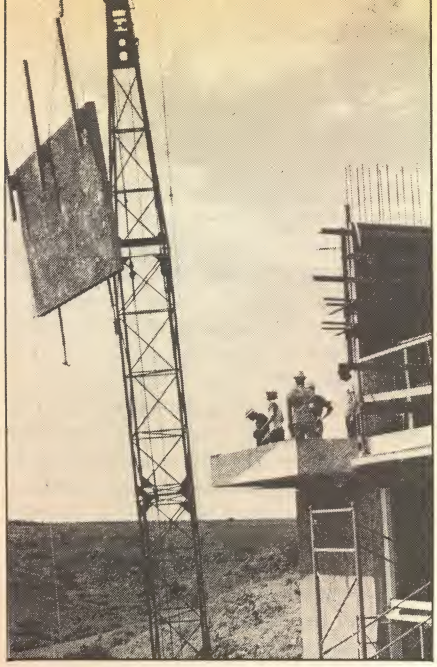


PHOTO: DAVID WING

PHOTOS: DON RUDDY

Clockwise from bottom: workers lay a sewage pipe from site of construction to oxidation pond, where refuse will be disposed of naturally and used as mulch. Pipe was laid in summer 1975. Left: Arcosanti to date—vaults and apses on a rocky mesa. At left of picture, lab building now used as workshop and residence for summer help. Top left: crane lifts modular panel to begin construction on lab building in 1975. Top: student workers from the summer of 1975. Photographer Ruddy is at far right.

ing radically conceived bridges and houses that fulfilled his principles of "efficient use of space." One commission took him back to his native Italy, where he gained an interest in ceramics. And upon returning to the U.S. in 1955 he began to apply this new passion to the construction of his home and workshop complex in Scottsdale, not far from Taliesin West. Called Cosanti (a name which comes from two Italian words and means "before things") this home base featured Earth-sheltered rooms hollowed from under dome-like roofs made of natural desert materials. It was here that Soleri made his first "wind chimes," the sales of which supported him, and continue to support Arcosanti's construction to this day.

In the early 1960s he developed the concept of cities built on ecological principles, where homes and essential services and recreation are all within walking distance. Early examples were the now-famous "Mesa City," a plan for a "better Manhattan" inhabited by two million people, and his "Plan for the Cosanti Foundation." From these two conceptual models, built around 1965, Soleri evolved the idea of a city as a *single massive structure*—three-dimensional, self-contained, and space-efficient. And in 1970 he began

the construction of one such "arcology" —Arcosanti.

"It is a model," Soleri says. "Not a model in the sense that everyone should be doing it, but in the sense that it is a modeling process—a prototype, a testing ground.

"I think it's essential that any society which is at the point that we are at, allows and demands testing, because that's the only way we can really anticipate what we are going to do. And in urban problems, which are much more difficult—in totality—than the problems of space flight, for example, we are refusing to test."

This testing, to Soleri, goes far beyond the physical and technical problems of supporting a city like Arcosanti. It is also concerned with our whole conception of how and why human beings live—what motivates us, what makes us happy. According to Soleri, "Because science through technology is taking us away from poverty and struggling for survival, we think it is also giving us happiness. It's not —perhaps because happiness is just an illusion—but if you go after happiness as a consumerist, you'll never find it. You are going to find comfort and some security and so on, but not fulfillment."

Spiritual fulfillment is something not usually associated with a practical art like architecture, but Soleri doesn't separate them. Theology, philosophy, technology, engineering—all combine in the arcological viewpoint. And from that viewpoint, consumerist cities like Phoenix and Los Angeles, with their freeways and golden arches and ghettos, are nightmares. "I tend to believe that the Phoenix syndrome is going to disappear. Anyhow, it's not the rule, it's the exception. If you look at the cities of Western Europe you don't find the Los Angeles mushroom, you find the opposite—clustering, highly organized and intense life....I think it's going to be a short-lived exception, not so much because of the cost of it. I think man is going to reject the isolation, the alienation, the waste."

Lovers of automobiles might be unhappy in an arcology. "The auto is one of the main technologies responsible for the undoing of the urban context," Soleri says. "A car is a marvelous machine, but it should never be used in a city. Never. There are no roads in Arcosanti."

Not that Soleri is against technology per se—quite the opposite. He has said elsewhere that technology, particularly the computer, can actually create certain day-to-day freedoms. Nor is Soleri ready to dismiss the idea of establishing space colonies. His first sketchbook included a structure called Asteromo, a space city "basically the same as the one Gerard O'Neill conceived.

"In a way, Arcosanti is an intermediate step between the traditional community and the space community" because space colonies, like arcologies on Earth, "will have to define their own ecological cycles."

He adds, however, "I have reservations about going into space. Not because of the necessity of going, but of the how and why we are going there....

"Quite evidently we are trying to transfer the affluence and the opulence that we have down here (into space). And this kind of opulence is not the reason we are here. It's not the consumerist that we have to try to put into space, it's something else—it's the human person....

"Going into space is really a theological trip. It's *not* a technical trip."

And even though philosophical and theological concerns form a large part of Soleri's arcological worldview, he is a practical man who has managed to turn his dreams into workable plans—and into actual structures.

Ten years ago he chose to build his "model" near tiny Cordes Junction, Arizona, seventy miles north of Phoenix. The 860-acre site was "not *too* far from Phoenix, with a better climate, water and power on the land. It might not be ideal, but it's a good choice." Construction began in the fall of 1970.

The work on Arcosanti, unlike that on other projects, is funded by donations and proceeds from workshops, sales of wind chimes and books, and Soleri's lecture fees. The workers, for the most part, are students who pay for the chance to study with Soleri—and to get a good deal of practical construction training as well.

In eight years this unlikely team of philosopher-architect and student workers has dug a permanent hold on the arroyo above the Agua Fria River. One percent of the planned structure is now complete. One new section, called the East Crescent (which includes living quarters for 60 people and their families), will be under construction soon.

But it is a continuing battle. The number of students is less than it was several years ago. Soleri says, "It is mainly that young people are becoming more conservative now. They are more interested in security and success, which is a disaster for the society at large." This, he thinks, is merely a wider reflection of the mood of the whole country. "It is a life cycle. We might go through quite a conservative period, a period of consolidation which might also be fossilization, and this, too, would be a disaster.

"Another reason is that when we started, we were the only ones doing this sort of work, for which you could get college credit. Now there are projects all over the world that students can get credit for."

Inflation and materials shortages (cement is almost unavailable in Arizona lately, no matter what price one is willing to pay) have also taken their toll. And, Soleri adds, "When you get into doing something, you find that everything is much more difficult and much slower than what you had planned."

Perhaps the most difficult work at Arcosanti still lies in the future: the construction of the massive, pyramid-like living quarters for five thousand people. Even Soleri concedes that the methods which have worked well for the last eight years won't be adequate for this job. "It's such a large undertaking that we will have to enlarge the whole system, from administration to technical expertise." Outside funds and workers will have to be found.

Despite the setbacks, Arcosanti continues to grow, and if all goes according to plan, Paolo Soleri and his "family" will take up residency there sometime in 1979. (There are already several dozen more-or-less permanent residents—they are workers.)

"Arcosanti is a little town, and we would like to see people living there in a decade. But we do not have the means at our disposal to schedule it. We are just going year by year, designing what we can, building what we can."

The eventual inhabitants of Arcosanti? "There will be quite a mix. People involved in thinking and producing and manual labor. Services, craftspeople, but not necessarily with a big accent. I'd like to stay with the performing arts."

In keeping with this spirit there is an annual festival at Arcosanti in the fall, a four-day party with "new games" held on a field below the city, art and craft shows, speakers, food and lots of music (one of last year's performers was Jackson Browne). The festival helps raise money to keep the work going, and it also serves to give consumerists a taste of life in the arcological mode.

As it appears, the determined architect and philosopher will get a chance to put his model to work—someday. "The interest in what we are doing is far greater than it was in the beginning. So we are becoming, let's say, respectable and recognized." Applications from students still come in, and the teaching and workshops continue.

Assuming someone has an interest in Arcosanti, what should they do? Soleri smiles. "They can write to us. If they are university students, credit can be arranged through their schools. If they feel a sense of responsibility toward the future—and not just *their* future, but the future of all of us—then I think we might offer something very important."

For further information write:

COSANTI
6433 Doubletree Rd.
Scottsdale, AZ 85253

Body Snatchers

(Continued from page 29)

Kaufman relates, "a psychiatrist living in Marin County who had never done a score before. But he is a well-respected avant-garde jazz composer and performer. I think he was able to get inside both the performers and the audiences."

But this was only the first audio surprise. Kaufman knew from the beginning that he wanted to employ a sound technique thus far relegated to productions like *Earthquake,* in which the sound (Sensurround in this case) was a major component of the film. "We knew we were going for a Dolby sound of some kind even when we were shooting," Kaufman continues, "because some of the film's shocks had to be sound shocks connected to the visuals. Dolby thinks ours is one of the best examples of their craft. Not just loudness or music, but a sophisticated mixture of silence, dialogue, sound effects, stereo and 'surround,' combined properly."

All this technical texturing was layered on what Kaufman calls, "a film of small moments," made real by the characters in W.D. Richter's screenplay and the actors who portray them. Set for the leading roles of a city health official and a practicing psychiatrist (the film's main antagonists) are Donald Sutherland and Leonard Nimoy.

"The two took tremendous care with their characters," Kaufman says, "asking over and over, 'But if he did this here, why would he do that there?' Or, 'If the character acted this way now, why does he react that way later?' And then we would have to sit down and talk out every objection before filming began."

Principal photography was finished on *Invasion of the Body Snatchers* on New Year's Eve 1977. Seven more months were taken up with editing, sound transferral and other post-production chores. United Artists, impressed with advance screening reactions, scheduled the film's premiere for December 22, 1978. At the time of its opening, Philip Kaufman was up to his neck in post production work for his new non-science-fiction film, *The Wanderers.* Even though he's intent on bringing this new movie to life, the director offers a last comment on his ground-breaking SF effort.

"*Invasion of the Body Snatchers* was a joy to make in the respect that we learned things all along the way. We knew what we were shooting for and we were constantly surprised with ourselves and each other. This helped to make the film, I hope, special. It is not a film audiences might enjoy in the same way as, shall we say, other, lighter films. I think the movie is frightening. I hope audiences agree. But with the passage of time, who can say? Did I create a symphony of terror?"

SPACE ON $5 A DAY

By LUIGI COZZI

Editor's Note: Luigi Cozzi is Italy's biggest SF fan. At the age of 13, he started that nation's first SF fan magazine, Futuria Fantasia, *a publication named after young Ray Bradbury's fanzine. In 1965 he began translating American SF books into Italian, eventually becoming both an editor and the agent for A.E. Van Vogt and Hugo Gernsback, among others. With Gernsback's blessing, he created the Italian Hugo Awards. In 1969 he made his directorial debut with a TV adaptation of Fred Pohl's short story, "The Tunnel Under the World." Shortly thereafter, he became a film director, the organizer of the annual Italian SF Film Fest and the distributor of such classic science-fiction films as* Silent Running, The Thing *and* Lord of the Flies. *By the end of 1976 he had grown tired of distributing other filmmakers' excursions into SF and decided to experiment on his own. And so began the saga of* Starcrash *or* The Adventures of Stella Star... *Italy's first big-budget space opera.*

I have always wanted to make a science-fiction film dealing with the far-flung future, to take an idea and then carefully build it into the ultimate futuristic adventure. I guess it's ironic that *Stella Star,* my first science-fiction movie, came about almost totally by accident.

In 1977 I decided to direct my first serious science-fiction film. I wrote a story entitled *Saturn on the Horizon* which dealt with a gigantic space disaster. A colossal

Director Luigi Cozzi confers with the evil Count (Joe Spinell) on one of the film's sets.

Menaced by the incredible shrinking budget, Italian filmmaker Luigi Cozzi was forced to cut corners making "The Adventures of Stella Star." Here is Cozzi's remarkably candid first-hand account.

Filmstrip from top to bottom: one of *Stella Star*'s fighter craft; two animated robot warriors based upon the pair of skeleton fighters in *The 7th Voyage of Sinbad;* a spacey interior set and The Emperor of the Universe himself, actor Christopher Plummer. All of *Stella*'s lush imagery was created within days.

Above: the smaller of two models built of the gigantic floating city is placed upon its rolling track. The city moves across the space backdrop on the monorail-type device. In the finished film, it appears to glide through outer space. Above left: the spaceship *Murray Leinster* zips by a planet only to run head-on into a futuristic ambush. The *Leinster* is, of course, named for the SF writer of the same name. Left: colored by rainbow-hued lights, the floating city heads for an exciting climax . . . a star crash. Although the finished models and spaceships look incredibly expensive, Cozzi and company managed to cut costs at every corner. All the spaceships were designed and constructed from toy model kits and bric-a-brac.

spaceship is destroyed while cruising along Saturn's rings and a few survivors fall onto Titan . . . their struggles forming the basis of the movie.

To promote this concept, I had a friend, animator/special-effects artist Armando Valcuado, create a seven-minute film entitled *The Conquest of the Solar System.* I took this around to an Italian producer along with pre-production designs and was greeted with the type of enthusiasm usually reserved for a leper. I was told that, in Italy, science fiction was box-office poison.

Discouraged, I went to Cannes in May of 1977 where I cornered French producer Nat Wachsberger. He was very kind but told me that he didn't understand science fiction at all and didn't really care to. I was about to shelve the project when, fortunately, *Star Wars* opened in the United States. Wachsberger called back and told me to give him all of my material for the film. He was leaving for the U.S. and was sure he could sell it. I gave him everything—and waited.

In July he called me from Los Angeles and told me that he had backing from American International (AIP) for an SF film but that AIP didn't like my story. He asked for something that had "all the monsters from *The Land that Time Forgot* (a stateside hit) and all the space elements from *Star Wars.*"

I told him that I didn't quite agree with his approach. I hadn't seen *Star Wars* but I had seen *The Land that Time Forgot* and truly loathed it (being a Ray Harryhausen fan and a stop-motion animation booster). To try to save my film, I called him back and told him that I'd seen the light and that next week he'd have a finished script. Borrowing a tactic from *Forbidden Planet,* I hastily concocted a story over the phone wherein all the monsters were invisible—too horrible to imagine. Everyone loved the idea. I didn't know it was even an idea.

Sitting down at my typewriter, I started to pen a storyline similar to the ones found in the old SF pulps. Using an old A.E. Van Vogt trick (inserting a plot twist every three pages to leave the audience guessing about what the devil is going on), I wrote *The Empire of the Stars* or *The Adventures of Stella Star*—an obvious steal from *The Adventures of Luke Skywalker.* The producer loved the story. So did AIP. And so, a futuristic film was born, and retitled with AIP's new name . . . *Starcrash.*

Starcrash is pure futuristic fantasy. It opens in an unexplored "galaxy of the accursed," where the Imperial Navy spaceship, *The Murray Leinster,* is searching for the uncharted planet Gorgonia, the lair of the evil Count Baron Zartan. Zartan is preparing a super-mind weapon that will invisibly control the universe. He must be stopped. The *Leinster* is attacked in space by an unknown force and destroyed. Three escape pods zip into deep space, surviving the holocaust.

The Emperor of the Stars (Christopher Plummer), understandably upset by the massacre, sends his best pilot, Stella Star (Caroline Munro), and co-pilot Akton (a humanoid from the Lost Race of Vega Nine endowed with fantastic mental powers and played by Marjoe Gortner) to investigate. Joining the Emperor, Stella and Akton are Thor, a trusted transmissions specialist, and the loyal robot Helle (Judd Hamilton). After the first of the escape pods is found destroyed, the band of heroes goes searching for the surviving two pods and for clues to the cause of the disaster. On the planet Arrakes they find an empty pod and are attacked by Amazons, but they escape.

On another planet, a planet of ice, they find the wreckage of the *Leinster.* The Emperor is crushed. His son, Simon (David Hasselhoff), was aboard the starship and it had been the Emperor's hope that he would be found alive. While on the planet, Thor turns traitor and attempts to freeze his comrades alive. Stella is indeed frozen, and dies. Akton, however, kills the traitor and Helle revives Stella by trans-

Filmstrip, top to bottom: a stop-motion Amazon; Stella; the alien "head" of justice; the floating city.

Left: director-writer Luigi Cozzi supervises the lighting of the fabulous floating space city. All the miniatures used in the film were painted metallic grey and then colored through the use of tinted spotlights.

PHOTOS © 1979 LUIGI COZZI

planting Thor's internal organs into the woman.

The group heads for yet another planet where Akton believes the third pod lies. As they approach the planet Abbar, their spaceship is invaded by gelatinous monsters identical to the ones that did in the *Leinster*. Akton fights off the monsters, which are really Zartan's thought projections. The party separates, with the Emperor remaining aboard the ship. The landing party on Abbar is attacked by Troglodytes but is saved by a gold-masked stranger who eventually turns out to be Simon Rama, the Emperor's son.

The planet Abbar, it turns out, is really Gorgonia. The landing party discovers Zartan's lair and his thought-projection machine. Simon and Stella are captured. Helle is destroyed. The twosome are left on the planet, guarded by skeletal robots. A fleeing Zartan tells tham that, in a few moments, the planet will blow up. The Emperor of the Stars, who is on his way to rescue them, will be destroyed in the explosion. Zartan escapes. The Emperor arrives and a fight between the robots and humans ensues. Akton dies and the Emperor suspends the flow of time, thus allowing the trio to escape.

In space, the Emperor battles the forces of Zartan who, surprisingly enough, wins the skirmish. Zartan orders his men to activate the mind machine, aiming the lethal rays at the Imperial capital plane. The Emperor realizes that the only way to save the galaxy is to create a starcrash! Stella and Simon and a rebuilt Helle launch the cosmic island of Futuria, sending the floating city on a collision course with Zartan's *Space Claw*.

The trio escape shortly before the two massive structures collide. Zartan is killed. *The Space Claw* is destroyed.

As you can see, the movie is a sort of futuristic Sinbad adventure in space. Along the way to production, however, the script lost a lot of its swashbuckling touches, due to either AIP's or the producer's orders.

There was some mild sex in the original script. At one point, Stella stood naked in a rainbow-colored energy shower during a scene inspired by the transparent cylinders used in *This Island Earth*. Before a spool of film even got *near* a camera, all nudity was ordered o-u-t by the powers-that-be in order to get a G or PG rating. Later on, I discovered that Ms. Munro wouldn't have done any nude scenes anyway. Pity.

We lost a lot of spectacular scenes because of budget restrictions as well. In the finished film, Stella trudges across snow-caked terrain on an ice planet. In the original script, she flew using artificial gossamer wings. Moreover, the planet was actually written to be a boiling, molten world! My producer estimated that it was

too costly to build volcanic sets and so the scene was axed. We filmed the whole snow thing in Monte Terminillo, less than 60 miles from Rome. I wanted to go high up in the Alps but that seemed to cost too much, too. Pity.

A lot of our clever plot twists, eventually, were twisted out of the plot altogether. Count Zartan, for instance, started out as the Emperor's cousin who was out to eliminate Simon in order to make himself heir to the throne. In the finished film, he's simply crazy.

The mind-control machine in Zartan's underground lair was originally portrayed as the last remnants of an ancient civilization, machines that were working years after their builders had destroyed themselves in the ultimate war. The name of the planet housing the lethal machines was Earth. The name of the destroyed race, humankind. All of this was removed from the plot because it was considered too downbeat for American audiences.

I was pretty unhappy with the way the script was being revised and, in order to placate me, the producer asked me to come up with a new ending of my own design. I came up with two. The first ending was the big battle in outer space between the Emperor's fleet and Zartan's. Still unsatisfied, I was inspired by a poster distributed by AIP (and having nothing to do with the movie) showing a girl flying in space with a sort of mothership floating city nearby.

I thus combined key elements in my ending culled from *Star Wars* (big battle) and *CE3K* (the appearance of the mothership), presenting both a dogfight and a starcrash. Everyone was happy with that idea but that didn't stop them from changing the script a bit more.

The Emperor's proposed space station, the regal *Futurio,* bit the dust because our budget only allowed for one miniature of a space station. So, my poor Emperor of the Universe has to stick to his Admiral Flagship throughout the movie while Zartan has his *Space Claw* knocking the hell out of the galaxy. Somehow, I also managed to lose one of my main characters during the film's finale, too. My original script called for Simon and Stella to both be aboard the floating city prior to the starcrash.

That scene was late in coming, however, and actor David Hasslehoff, who played Simon, had to return to Los Angeles during the film's final few days of shooting. We had to film Simon dropping Stella off at the floating city and then rescuing her once the crash was over. That not being a very heroic action, we hastily wrote in a scene wherein Simon gives Stella the rebuilt robot, Helle, for company. Thus, the robot took the human's place in the big finish. Oh well, I did my best.

In order to keep myself aloof from the constant script changes, I injected quite a few SF cliches for science-fiction fans to spot...some of them made it into the film, some didn't. The alien Akton was originally conceived to be entirely alien, with a soul like *This Island Earth*'s Exeter but with a crab-like body. Marjoe Gortner, a nice fellow who portrays the alien, refused to wear any makeup on his all-American-Boy, smiling face...so much for crustaceans in space.

To keep myself in good spirit, I introduced elements into *Stella* culled from films I really enjoyed. Stop motion ala Ray Harryhausen is used quite a bit. The skeletal robot duels are straight out of *The 7th Voyage of Sinbad.* The giant silver Amazon statue was inspired by Talos, the bronze giant of *Jason and the Argonauts.* The man with the golden mask was derived from a similar character in *The Golden Voyage of Sinbad.* The tentacled judge was based on the Martian leader in *Invaders from Mars,* the spaceship *Murray Leinster* is named after the famous author, the mind monsters are patterned after *Forbidden Planet*'s Id Monster. Simon Rama is partly Simon Ashton from Leigh Brackett's Skaith trilogy and part of the title of Clarke's *Rendezvous with Rama* and Gorgonia is derived from the monster Gorgo.

These little plot details kept everyone busy and happy. However, with the cameras rolling, everyone on the set found out that envisioning the future on film isn't all it's cracked up to be. When you're short a few dollars, an entire planetary system can disappear!

Stella Star began as an admittedly low-budgeted effort (in U.S. terms) to be shot in six weeks for $500,000 dollars. That's why I wrote a script concerning a mere handful of characters. The more we shot, however, the higher the budget went, ending up at close to $2 million. A lot of the money was spent because of our utter confusion.

For instance, we actually started the movie in September of 1977 with no preparation at all. We were suddenly given the green light and a shooting schedule. Two days before shooting was to begin, we had no props. We didn't even have boots for Ms. Munro. And when Stella's boots did arrive on the set, minutes before our first shot, they turned out to be too small. Caroline couldn't even get her feet inside them. We had to cut the bottoms out of them, so, on the screen, in a few scenes, you'll see Stella wearing skintight boots up to her knees...but you won't see the shoe's soles. They don't exist.

There were 96 technicians who created all our props in two days. Our biggest problem with our futuristic gadgetry during the first week of shooting was the inherent danger in touching anything ...everything was covered with wet paint! At times, we even had to stop shooting because the props weren't out of the workshop as yet—an entire set hanging around waiting for their handguns.

Fortunately, we were able to give the movie a big, expensive feel via the extensive use of miniatures. Most of the spectacular sets are miniatures...slides projected via a dynamation screen. When I was forced to use full-sized sets, I had them constructed in such a way that I could use them at least twice by rearranging furniture or filling them with smoke and fog. Some spaceship sets were redesigned and repainted so we could use them three different times as three different spacecraft.

The finished movie, thank goodness, is a colorful tale that has the same flavor as *This Island Earth.* This is largely due to the special effects concocted by our effects department, which was really one man... 32-year-old Armando Valcaudo, a Ray Harryhausen fan specializing in animation. He got the most out of very little.

Our miniature ships were built by a few local boys, led by 20-year-old Paol Zeccara, from designs by illustrator Niso Ramponi. Most of the miniatures were painted silver because of our time schedule. They appear in different colors on the film thanks to the use of colored gells placed in front of spotlights.

Our small budget forced us to be truly creative in staging futuristic spaceflight. We had to stretch our dollars for effects. Our sky was made of black paper, the height of a stage wall. Filled with pinpricks, the paper was illuminated from behind, thus creating a starfield. The spaceships moved through the heavens on a monorailed track, attached to wheels at the bottom of the model. The track was masked out on the camera lens and then more sky was superimposed on the bottom half of the screen, thus giving the illusion of spaceflight. This is the same system used by Melies in the early 1900s.

Cutting costs to the utmost, we even had to use our planets twice. The plastic, transparent spheres used in our universe are actually used as decorations in scenes filmed in the great hall of Gorgonia. For moons we used small soccer balls, colored by gells. Somehow, all this worked!

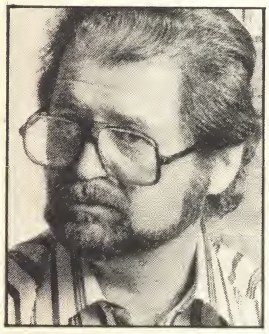
Still, our budget plagued us. We never could use blue- or black-screen process photography because, frankly, there are no labs in Italy able to handle it properly. Matte paintings were also out because no one has mastered that art in this country. So, we were forced to use a lot of front- and back-projection shots, with stars projected onto the outside of windows, etc. Our ray guns fire because of frame-by-frame animation and, at times, because of carefully aimed spotlights. After what seemed an infinity of cutting corners,

(Continued on page 74)

Future Forum is designed to expose our readers to the thoughts of a variety of experts in the fields of science fact and science fiction. Each issue will pose a new question to our "guest panel" on a particular aspect of SF, space-age technology or future trends.

Do you think you'll have the opportunity to travel to space within your lifetime? Would you take advantage of it?

NIVEN



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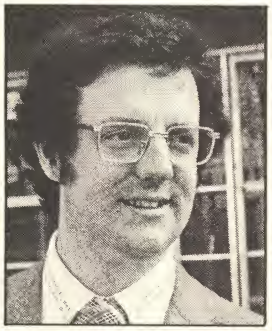

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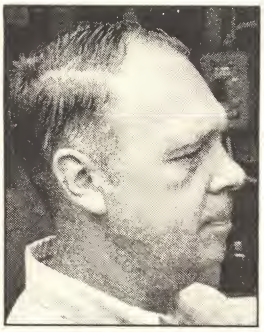

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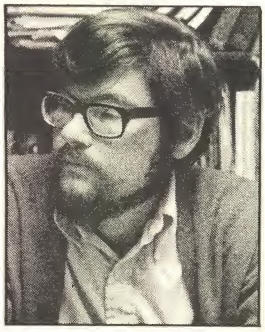

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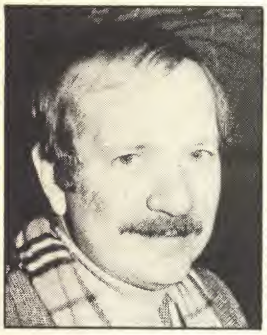

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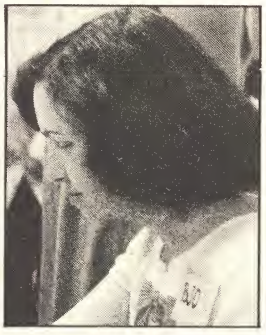

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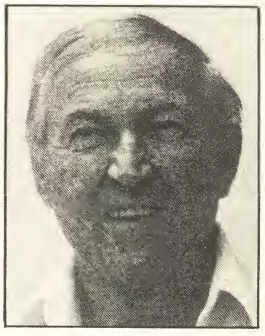


BRADLEY

LARRY NIVEN

One of the top names in science fiction, his latest books include the award-winning **Ringworld, A World Out of Time, The Magic Goes Away** and **Lucifer's Hammer** (with Jerry Pournelle).

I'd grab at such a chance. And it's possible. I'm not in astronaut's training, but I'm in good shape. What I'm hoping is that— sometime in the next 20 years, while I can still make it—NASA will do a publicity stunt: ship a dozen of the most able science-fiction writers into orbit in a windowed canister built for the shuttle's cargo bay. With luck I'll be in the top dozen and Jerry Pournelle—who would be a better choice—will be too old.

MARK R. CHARTRAND III

The chairman of the Hayden Planetarium.

Of course I'll have the opportunity to travel in outer space. Once the shuttle gets flying, almost anyone will be able to. Would I take advantage of it? Surely you jest....

HAL CLEMENT

The pen name of Harry C. Stubbs, he's the hard-writing SF author of **Iceworld, Mission of Gravity, Cycle of Fire,** the classic **Needle** and its recent sequel, **Through the Eye of a Needle.**

I rather doubt I'll get the chance; my advancing age seems to be reducing the probability at least as rapidly as the growing technical capacity is increasing it. I would most certainly take advantage of it, as I would jump at the chance to visit the deep sea bottom in one of the modern research submersibles.

GREGORY BENFORD

Associate professor of physics at the University of California, he is also the author of **Jupiter Project, If the Stars are Gods, In the Ocean of Night** and his most recent work, **The Stars in Shroud.**

I'll probably be able to get into orbit as a paying passenger on the shuttle in the 1990s. If I can afford it, I'll go. They may well have a hell of a time getting me to come back down.

CHARLES H. SCHNEER

Producer of **Mysterious Island, First Men in the Moon, Sinbad and the Eye of the Tiger, The Three Worlds of Gulliver, The Seventh Voyage of Sinbad, Jason and the Argonauts, The Golden Voyage of Sinbad** and the upcoming **Perseus and the Gorgon's Head.**

No. No.

GAHAN WILSON

World famous cartoonist and author whose work has appeared in **Playboy, Punch** and **The New Yorker.** He has a regular page in **The Magazine of Fantasy and Science Fiction** and an ongoing comic strip called **Nuts** in **National Lampoon** magazine. Recently he served as designer for a series of **Time** magazine animated television commercials. His most recent book is **And Then We'll Get Him.**

Yes. Yes.

POUL ANDERSON

Author of **Tau Zero, A Midsummer's Tempest** and **The Earth Book of Stormgate,** among others. Winner of both the Nebula and Hugo awards.

This depends on a lot of unforseeable human factors. Given a good, strong impetus continuing in a space program... well, in 15 or 20 years they ought to be able to take me as a passenger at a price I can afford. Or maybe someone will commission me to write an article about it. Would I go? Hell, yes. This very minute!

BJO TRIMBLE

SF artist, fan, writer and editor. Author of **The Star Trek Concordance.**

I'd hope there would be space travel in my lifetime. If we can't keep the government from chopping the space programs back to $1.98 each time there's an election, maybe we'll make it. The space shuttle program looks as if space travel for nonmilitary types and us mundanes *may* be possible...we can hope. It was for this reason I helped get the shuttle *Enterprise* named; *not* because of *Star Trek,* but because it was a good focus to get lots and lots of public interest in the space program. We could have named the shuttle "Phred" but it would not have engendered quite as much letter-writing enthusiasm!

GEORGE PAL

Award-winning producer of such films as **The Time Machine, When Worlds Collide, War of the Worlds, Doc Savage: Man of Bronze, Destination Moon, Conquest of Space** and **The Seven Faces of Dr. Lao.**

While it would seem improbable that I, at my age, will have the opportunity to travel into space, I nevertheless dream it could be true. I would be the first in line to get a ticket.

MARION ZIMMER BRADLEY

SF author and originator of the Darkover series. Some of her more recent books include **The Spell Sword, The Shattered Chain, The Heritage of Hastur** and **Stormqueen.**

No to the first question and no to the second. The Establishment would make sure that no nonconformist like me would ever get into space. Space is for people who would never rock the boat. Look at the astronauts!

INTERVIEW-PORTFOLIO

Hope for the Future

David Hardy

Britain's top space artist says, set your sights on the stars

By ROBIN SNELSON

David Hardy has been called one of the few "pre- and post-Space Age" space artists working today. Due to the slow pace of the American space program in recent years, it may sometimes seem as if space exploration is a thing of the past. But Britain's leading space artist, David Hardy, insists that the Space Age is only warming up.

NASA's future projects are already part of Hardy's productive past. His compelling paintings of future space travel just *begin* with Moon settlements and space habitats. He's been exploring the solar system, on canvas and through telescopes and books, since before Sputnik. England's David Hardy is impatient to get on to the stars.

With his penchant for scientific accuracy (or, in the absence of facts, solid scientific rationale), and his gifts of imagination and artistic skill, Hardy makes the Universe look so appealing and intriguing, it can cause you to wonder why we're not in more of a hurry to explore it. And that's exactly his intention.

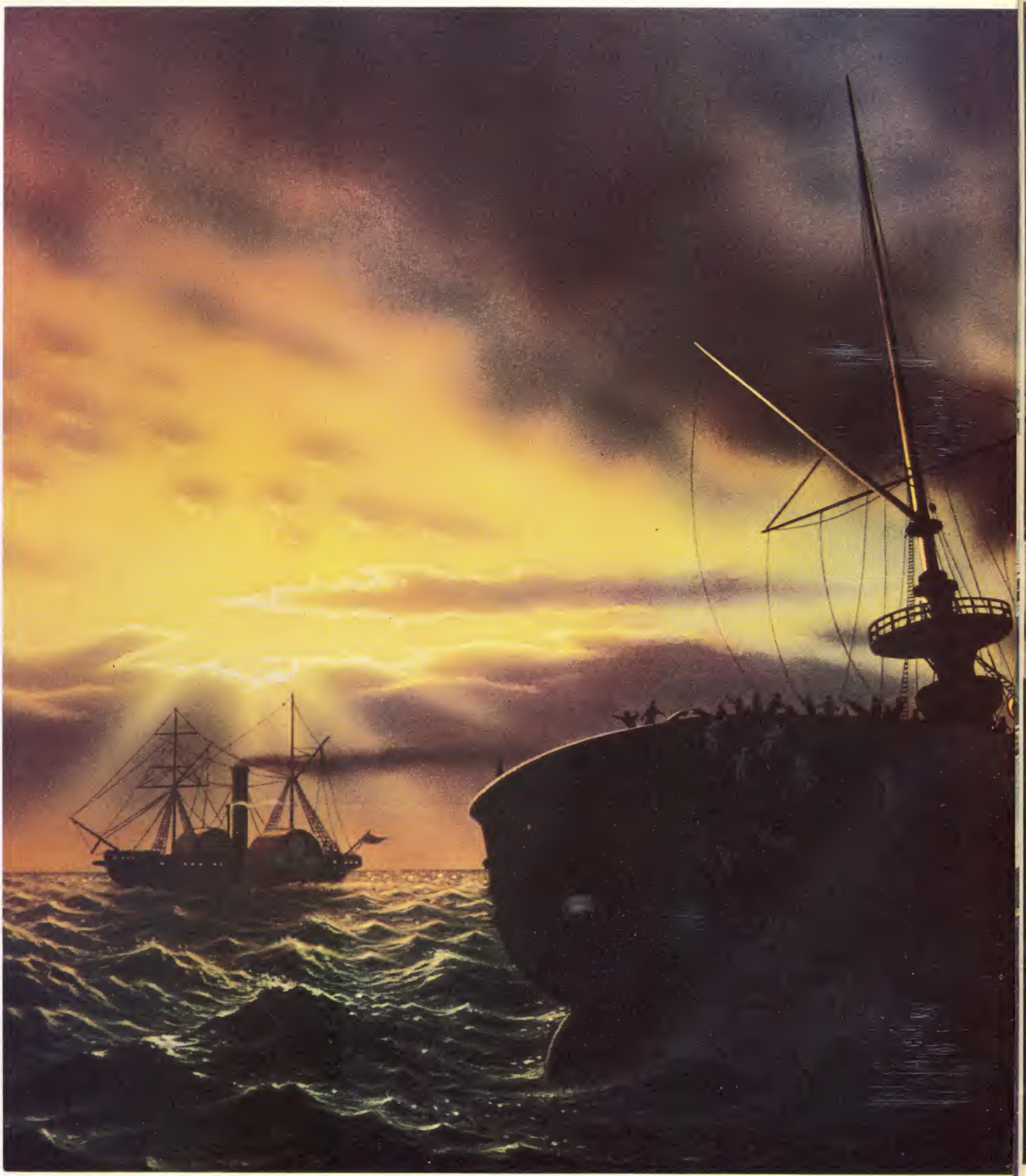
"I think astronomical artists and science-fiction writers and everyone involved in that field have a very important role to play," says Hardy. "Our task is to prepare people for what's going to happen, show the public how the future might be. If we weren't around to set the scene for them, I don't know if it would ever happen at all."

Widely recognized as a talented astronomical artist as well as a top science-fiction artist (several covers a year for *Fantasy and Science Fiction,* plus SF book covers and album jackets), Hardy has recently added writing to his repertoire. In 1975 he did his first book for young readers, *The Solar System,* closely followed by *Rockets and Satellites.* His astronomical paintings are used in planetarium shows the world over, and he has worked on educational filmstrips, television programs and rock music shows. A common theme in all of Hardy's work is to project an accurate picture of space and space travel. He wants people to set their sights on the stars.

An avid science-fiction fan, Hardy is chairman of the Birmingham Science Fiction Group. "My top favorites are hard science stories," he says. "I suppose my favorite author would have to be Arthur Clarke, because his writing is scientifically accurate, with good visual reference which I can imagine as an artist."

Hardy also has a fondness for Asimov and Heinlein, Larry Niven and Jerry Pournelle and newer authors such as James P. Hogan and Gregory Benford. And he's

David Hardy at work in his Birmingham, England, studio. Opposite page: "Metal Planet," painted before *Star Wars.*



currently collaborating on a book with British SF author Bob Shaw—a beautifully illustrated volume which will take a scientific look at science-fiction themes.

Working in his Birmingham, England studio while he listens to the space rock music of Pink Floyd or Genesis, it's hard to believe that the youthful (at 42) Hardy's work pre-dates the Space Age.

"I've been at it for 25 years now," Hardy says, "and things have changed a lot. When I first started it was a case of mainly making up your own ideas, even for vehicles to travel to the Moon. Now, of course, there's so much more knowledge to draw upon."

His fascination with things extraterrestrial was sparked at a young age. "I guess it all started with looking at the Moon through a telescope and realizing it was *another world!*"

As a child, Hardy spent many nights staring up at the starlit skies. In 1950, at the age of 14, he did his first drawings and paintings of possible worlds circling those stars with which he was so familiar. He tried to imagine how the night sky would

look on a planet orbiting a sun in the middle of a dense, globular star cluster... and he tried to picture spaceships which might travel there.

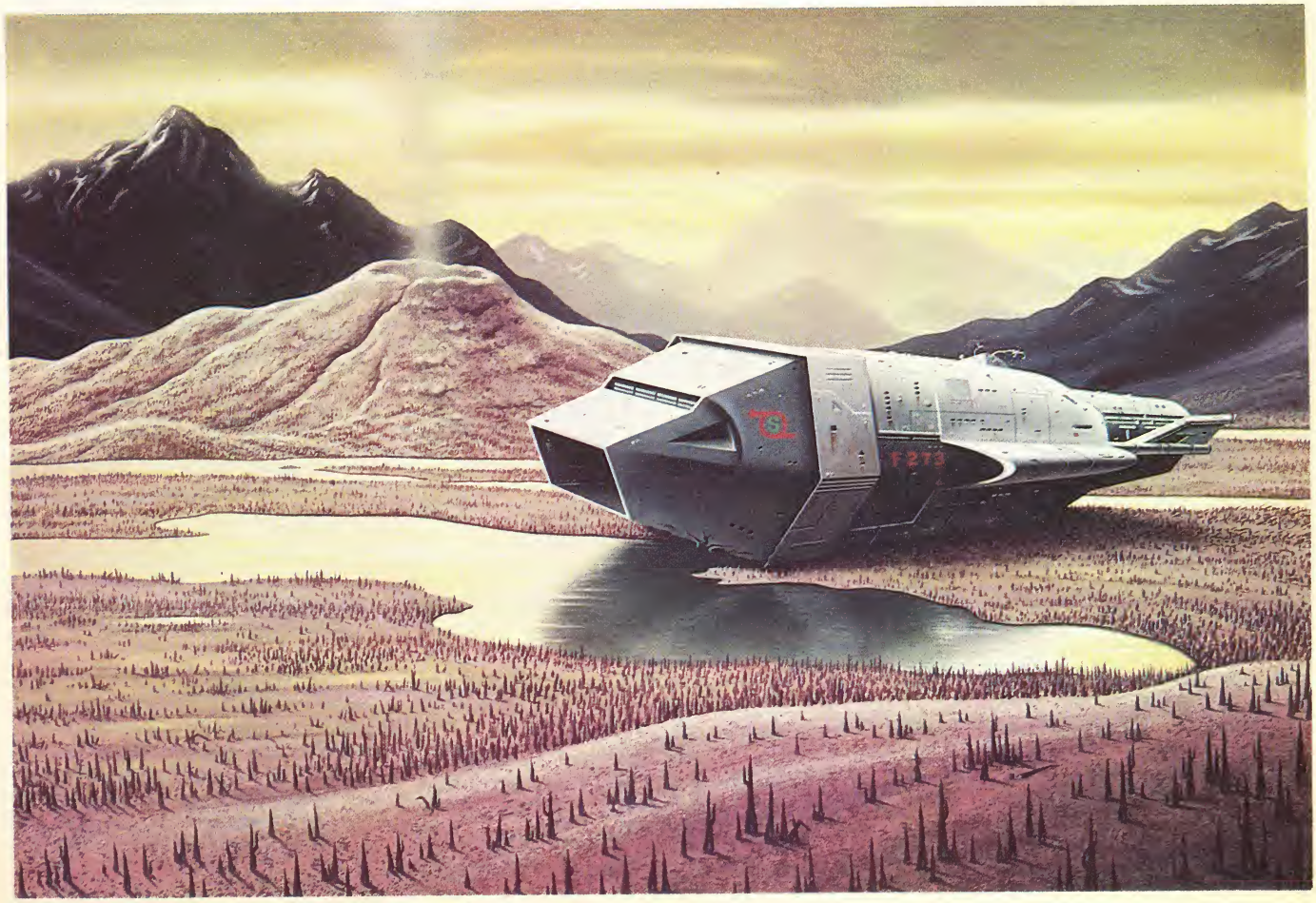
To add substance to his artistic imagination, Hardy studied science in school. And he kept painting, inspired particularly by the "photographic" astronomical art of Chesley Bonestell.

At age 18 Hardy illustrated his first book. The young artist found a kindred spirit in the book's author, British astronomer Patrick Moore. The two have since collaborated on a number of handsome, informative space and astronomy books. But their first ambitious book idea, admittedly a bit ahead of its time, took 15 years to get off the ground.

Martian fighting machines from H.G. Wells' *War of the Worlds*. Hardy calls this scene of the ironclad *Thunder Child* making a last suicidal bid to ram the alien invader "pure science fiction." Artwork is from *The New Challenge of the Stars*, by Patrick Moore and David Hardy, published in the U.S. by Rand McNally & Company.

Left: "Joyride." Hardy's most lovable creation takes a ride on the abandoned Lunar Rover. Bhen, the benevolent Bug-Eyed Monster, has appeared five times on the cover of *Fantasy and Science Fiction,* always pictured with accurate renderings of NASA hardware. Bhen made his debut in 1975, puzzling over the Viking lander on Mars. Carl Sagan promptly purchased the original. Below: "Emergency Landing," a recent Hardy painting for a book in the works with British SF author, Bob Shaw. Hardy describes the scene: "An interstellar liner, which although not designed to make an atmospheric landing on a planet, was successfully brought down on Excalibur—with no loss of life among the 2,000-plus colonists. The pilot brought it down on marshy ground. The size of the ship can be judged from the fact that the alien vegetation is equivalent to trees 30 or 40 feet in height. The sky is permanently yellow, due to a harmless micro-organism, while the predominant colors of life are pale violet, purple and mauve."

David Hardy prints, posters and slides are available from Astro Art, 99 Southam Road, Hall Green, Birmingham, B28 OAB England. An International reply coupon at airmail rate will bring a list of what's available.



"I'd love to travel into space.
I'd love to live in an O'Neill space habitat.
But I'd also like to see some terrestrial
wonders. . . alien landscapes on this planet."

One year before Sputnik officially opened the Space Age, Hardy and Moore were trying to sell publishers on a book called *Challenge of the Stars*. Moore would write the text and Hardy would do the paintings, to illustrate in a popular, visual format how space travel could be achieved. Based on studies by the British Interplanetary Society and other eager armchair space travelers of the day, the book would outline a flight to the Moon . . . for starters.

"We couldn't get a publisher interested, Hardy recalls. "They said it was too speculative. They called it science fiction."

Thirteen years later, in 1969, a spider-legged craft resemoling Hardy's "science-fiction" spaceships carried the first men to a landing on the Moon.

In 1972, Hardy and Patrick Moore finally published *Challenge of the Stars*—a much-evolved version of their original idea—with 36 Hardy paintings that pick up where the Apollo program left off. (They recently revised the book, adding eight new paintings and a science-fiction touch. *The New Challenge of the Stars* was published in 1978 by Rand McNally.)

Although today Hardy enjoys his reputation as science-fiction artist, early in his career he objected when that label was applied to his work.

"I was doing what I believed to be factual pictures of what the Moon would look like and what Mars would look like, and people called them science fiction. As far as I was concerned, they weren't fiction. They were as accurate as they could be. . . before we'd actually been there."

Now that the style's intentional, he warms to the description. "I *am* a science-fiction artist, now. But I still like to distinguish between the factual stuff I do and the science fiction. I don't like them to be confused."

Just to confuse you, in Hardy's universe a starship stranded on a distant planet is likely to qualify as "factual stuff."

"It would be factual if I'd done the research to find out how a starship might look," he explains. "And I would have scientific reasoning for the way the scene looks."

Hardy's painted visions are always based on what he thinks is possible, and he does a lot of reading on the technical side to keep abreast of current space technology and astronomy. "It bothers me just how little some SF artists seem to care about astronomical accuracy and the facts of science," Hardy says.

Indeed, it may be his accent on accuracy which lifts him above many of the "pure" science-fiction artists. "When I finish a painting I want to be able to believe that that scene exists, and I want other people to feel the same way."

Hardy's favorite subjects are landscapes, massive starships, unfamiliar skies on fantastic, faraway worlds. He paints mainly in gouache and acrylics, doing only the roughest of preliminary sketches before committing himself to paint. He works long hours, day and night quite often, and it takes him from two days to two weeks to complete a painting. He will do oil paintings, but only when specially commissioned.

"Oil is no problem, just that it's so slow," Hardy says, betraying his impatience. "When I get started on a painting, I like to finish it. With oils you reach a certain stage, then you have to leave it for a few weeks. I like to keep at it."

Always busy on a variety of projects, Hardy likes to do as many different things as he can. One recent project is a book he's illustrating and writing for young readers, called *Energy and the Future*. "I wrote it for 15 and 16 year olds, the same as two previous books in the series, *Air and Weather* and *Light and Sight* (published by World's Work). But quite a lot of adults—the ones who sort of missed out on science—have told me they enjoy them as well," Hardy reports. "I try to set things out in a very simple way, without actually writing down to children."

Energy and the Future is intended to cover the whole energy spectrum, from a grounding in physics to alternate resources. "I try to tell as much about energy as possible, and about the options which are available to us for the future. Readers can make up their own minds about what we ought to do—whether we should have nuclear power stations or try alternative energy sources, like solar."

Not surprisingly, Hardy favors the alternatives, particularly solar energy collected and transmitted to Earth via orbiting power satellites. "I'm a member of the L-5 Society," he states, "and if only those people with good ideas, like Gerard O'Neill, had their way, we could get our energy from space. It's just a case of persuading the politicians and the people that that's the way we ought to do it.

"I'm doing my bit to spur them on," Hardy says, "in the way I can, where my talents lie—in the paintbrush and perhaps the typewriter."

In addition to his literary artistry, Hardy's spacescapes have also adorned the covers of many rock albums, most recently for the record "New Day" by Airwaves. A confessed devotee of rock music, Hardy's encyclopedic record collection dates back to the 1950s. He considers the music of Pink Floyd, Genesis, Electric Light Orchestra, Jefferson Starship and many others of that ilk to be "the natural music of the Space Age."

One ambition not yet realized is his desire to do matte work for motion picture backgrounds. He was contacted by MGM for *2001*, but for a variety of reasons, narrowly missed out on contributing to Kubrick's landmark space odyssey.

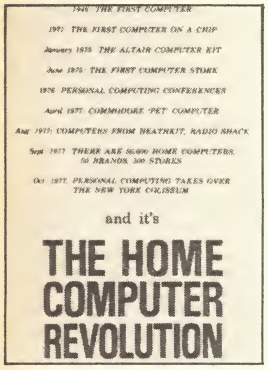
"But I like to amuse myself by making my own films in 8mm," Hardy says. "I get more and more ambitious with those, trying special effects and backgrounds." His first such film, a compilation of some of his paintings with a bit of animation, was called *2002: A Space Oddity*. "And that was *before* David Bowie made his record by the same title!" Hardy adds.

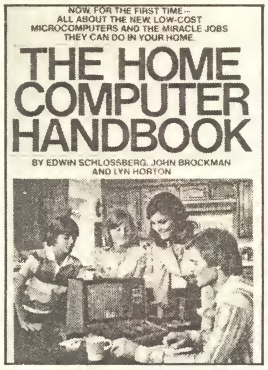
He also has travel ambitions. "I'd love to travel into space. I would love to live in an O'Neill space habitat," Hardy reveals. "I can't really see a great deal of prospects for getting into space myself, though. What I'd like to do, when I've got the time and money, is to travel around the world. I'd like to see some of the terrestrial wonders. . . the volcanoes in Iceland, or the Grand Canyon and Yellowstone Park in America. . . some of the really alien landscapes on this Earth. I think we've probably got more wonderful sights on this planet than one would find anywhere else in our solar system."

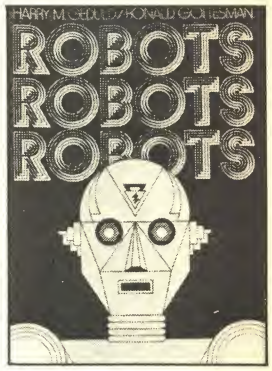
His abiding interest in space travel is based on something stronger than his personal attraction to exploration. "I'm not terribly hopeful about the future on Earth, as it stands," Hardy says. "I've just been rereading Harry Harrison's *Make Room! Make Room!*, which was filmed as *Soylent Green*. It paints a horrid picture of an overcrowded Earth. If things are going to be like that for our children. . ." he shakes his head.

"I'm optimistic, myself," Hardy continues. "Maybe it's just wishful thinking, but I tend to think it won't turn out like that. I agree absolutely with Isaac Asimov —space is our biggest hope for the future. If only people could be made to see it."

Toward that end David Hardy continues to produce stunning rainbow visions, beckoning us to explore the solar system and tempting us with intergalactic adventures and the promise of interstellar discovery. Hardy's work is a powerful statement of a growing conviction that humanity's future does indeed lie among the stars.







Computer Lit

By BOB MECOY

The cover of the January 1975 *Popular* Electronics announced "a computer you can build yourself for only $420." That was the first shot to be fired in the home computer revolution. By the summer of '78 there were more than 60 brands of home computers, more than 500 stores selling them and tens of thousands of them in homes across the country.

Once again the real world is catching up with science fiction. Computers are sneaking into the house disguised in games, appliances, televisions. Many new cars employ one or more computer-operated systems. But the *home* computer—cheap and getting cheaper—is going to be the world-shaker.

And so, realizing that a revolution is hard upon us, publishers are presenting a history of the computer—present, past, future.

Ted Nelson was a computer professional but he's become a computer *fan*. He sees us on the brink of a new world and the computer display screen as our gateway into it. He feels strongly enough to have published two collections of his visions of the computer and the near future.

Nelson's book, **The Home Computer Revolution***, *is* a revolutionary document: the home computer is about to change the world as drastically as the automobile or the telephone and no one, Nelson asserts, is ready for it.

The home computer is more than just a fancy numerical calculator, it's a general-purpose computer capable of being programmed for any purpose you can dream up—games, graphics, music synthesis, to help you run a business, or write, or... Fill in the blank yourself.

"The interactive computer screen will be our new home. The sooner we understand it, the better," Nelson writes. Computer screens are going to be on the kitchen table, by the bed, in the office and on school desks. With them you'll be able to type or simply point and the computer will respond instantly with the answer or directions for the next step. Information, entertainment, education will all be available in greater variety and more freely than ever before. Every medium of communication or expression will be evolving to accommodate new possibilities.

The book clearly states what is possible now and what will be possible in the near future and it's all amazing. The greatest strength of this book is that the computer Nelson is talking about is easy to understand, never threatening and always exciting. He gives the reader a distinct impression of what it's like to get your hands on one of these new toys and he assures you that there will be no white-coated technicians talking in strange mathematical languages. The only frustrating aspect of this book is that the concept would have only taken half as long to understand and been at least twice as much fun to learn about if only we could be shown it on an interactive computer screen.

If you're a beginner wanting to know the state of the art and where to find it, **The Home Computer Handbook** by Edwin Schlossberg, John Brockman and Lyn Horton (Bantam, $2.95) is for you. In contrast to the disorderly state of the industry, this book presents a wealth of well-ordered information.

The authors have prepared an excellent book for the neophyte. For once, a technical glossary comes first, so we can understand what's being discussed from the outset, acronyms and all. The explanation of what a computer is and how it works moves from the simple—"What's the difference between a computer and a calculator?"—to the complex—"How does a computer process information?"—in simple steps. The chapter on buying your own system is excellent, concerned more with analyzing the buyer's needs, wants and capabilities and dealing with your local supplier, than selecting hardware for you.

The how and why of home computing is laid out in the first half of the book. The second half contains nine appendices listing makers of home computers and peripherals, books and magazines about home computers, home computer clubs and stores and finally a short history of the computer. These sections will answer any remaining questions of who, what and where—you'll have to supply the when yourself.

If good planning makes great books, then *Handbook* should really sell. The only problem here is that the home-computer market is evolving so rapidly that much of this book could be out of date by the end of the year. But for now it is the best hope of the newcomer.

As computer hardware has grown cheaper and moved into every aspect of our lives, it follows logically that fiction writers should begin to speculate about computer software—the private "lives" of computer programs.

A computer is a machine that can follow a plan. The plan is called a program. **The Adolescence of P-1**, a novel by Thomas J. Ryan, (Colliers Books, $4.95) follows the coming of age of a program—the first artificial intelligence.

In Ryan's tale there are two types of computer programs: job programs that accomplish a specific task and supervisor programs that control the job programs. Gregory Burgess creates a super-program—a program set to enter a computer, take

Available for $2.00 from The Distributors, 702 So. Michigan, South Bend, IN 46618

over the supervisor program, keep its own existence a secret and, once that system is taken over, move on to the next system through whatever communication link is available. Burgess doesn't realize that what he's created was a program incorporating humanity's strongest drives—hunger and fear. When he puts it in one computer, P-1, in Toronto, the super-program moves into thirty systems across the country overnight. By the time he thinks of a way to stop it, P-1 is strong enough to ignore him and disappear.

Burgess thinks P-1 destroyed until it shows up on his office computer after three years and a thousand miles away from Toronto. To his horror the program is in control of every computer with any means of communicating with the outside world *and* thinks of him, Gregory Burgess, as his father.

Of course, a being with so much power can't escape the notice of our government forever, so this cybernetic combination of *Roots* and *Catcher in the Rye* has action enough to satisfy the most thrill-crazed, a twist ending for the perverse and a surprising lot to learn about the fascinating link between man and machine.

Meanwhile, for those who expect artificial intelligences to announce themselves with the patter of little metal feet around the house, there are two lovely books: **The Robot Book** by Robert Malone (A Harvest/HBJ Book, $6.95) and **Robots Robots Robots** by Harry M. Geduld and Ronald Gottesman (New York Graphic Society, $14.95).

The Robot Book, like the best of its subjects, is a marvel of design. Its more than 300 photographs and drawings show the dream of a functional robot progressing from puppet to automaton to Viking lander sitting on Mars.

The text is brief but cogent, outlining the history of thought and technology. It moves quickly from the historical origins of the robots to robots at work in industry, entertainment and the arts, shows how to build robots that work or just look good, and examines some of the future possibilities of our mechanical friends.

Robots Robots Robots is a literate collection of essays tracing the history in fact, fiction and fantasy. The idea of synthetic humans has fascinated humans ever since they figured which ones they were.

Here essays by two dozen literary luminaries are gathered. Among them are such classics as Poe's debunking of an early chessplaying automaton, Lester del Rey's "Helen O'Loy" and Mary Shelley's "Making of Frankenstein's Monster." More recent thought is found in works by Carl Sagan, Clarke and Pierre Boulle.

Books in Brief

The Lost Traveller by Steve Wilson ($1.95 in paperback from Ace). Touted as a "science-fiction western and motorcycle quest epic," *The Lost Traveller* lives up to its hype, shaping up as a sort of Peter Fonda meets Carlos Castaneda in the valley of *Damnation Alley* cliffhanger. After a pretty routine nuclear holocaust, the Los Angeles chapter of the Hell's Angels becomes the basis of a new civilization in the West. Years pass and, suddenly, it's the West Coast intelligentsia vs. the East Coast warmongers in an attempt to control the continental U.S. The key to unification of coasts turns out to be a scientist held by the the East and wanted by the West. A trio of Angels are dispatched on a suicide mission: rescue the scientist and lead the West Coast to victory. Bone crushing action and bone-headed philosophy mesh in a rock'em-sock'em scenario that should appeal to both action-adventure fans and Beach Boys lovers everywhere. (Ed Naha)....**A Fire In the Sky** by Walter Kendrick ($1.95 in paperback from Ace). Flash! A pee-wee league version of *Lucifer's Hammer* has appeared. A comet wipes out Phoenix, Arizona. Thousands of cliches are killed! Details at eleven! Mass apathy to follow! (E.N.)....**Freaks' Amour** by Tom De Haven ($9.95 in hardcover from William Morrow). A house in Jersey City, New Jersey is destroyed in an unexplained nuclear disaster, creating a race of bizarre mutants in the immediate area. In this newly-hatched ghetto of Freaktown, two twins, Flourface and Grinner, fight for survival. One becomes a drug dealer, the other, one half of Freaks' Amour...a brutally explicit stage act which depicts sadistic acts of love "live" for wanton audiences of "Normals." As performer Grinner makes his way from town to town, stage to stage, in an attempt to save enough cash for a normalcy operation, he uncovers a connection between his brother's drugs, the Jersey City holocaust and the United States space program that is both surprising and off-the-wall. A lot of wonderful narrative, excellent characterization and anemic plot twists are mixed in *Amour*; a novel boasting a truly fascinating premise but an ultimately unsatisfying conclusion. (E.N.). . . . **Worlds Beyond,** edited by The New Dimensions Foundation ($6.95 in trade paperback from And/Or Press). More than two dozen visionaries and futurists (including Buckminister Fuller, Gerry O'Neill, Jacques Cousteau, Robert Anton Wilson and Timothy Leary) contributed to this book of essays about topics ranging from space migration to the future of the oceans to new UFO theories. Gleaned from radio broadcasts by The New Dimensions Foundation, the essays have a pleasant conversational tone. Guaranteed to spark optimism about the future. (Robin Snelson). . . . **Our Lady of Darkness** by Fritz Leiber ($1.75 in paperback from Berkley Books). This is not Fritz Leiber's first trip into the world of gothic horror but it is his most recent. And, while it may not measure up in quality to his previous excursions, *Our Lady* is still a perceptive and frightening story of urban malevolence, mad magicians and paranoia. (Howard Zimmerman)....**The Courts of Chaos** by Roger Zelazny ($7.95 in hardcover from Doubleday). One of the most eagerly awaited SF books in several years, *Courts* is the fifth and supposedly final chapter in Zelazny's classic Amber series. The dust jacket blurb promises that this is "the book with all the answers," but that depends on which questions you were interested in. The plot is furthered but hardly resolved. By the end of the novel Prince Corwin has not yet arrived at the Courts of Chaos for his *final* final confrontation. And yet, on other levels—in terms of the big questions Zelazny has raised in the first four volumes, such as "what *is* the nature of reality?"—surprisingly satisfying answers have been supplied. In any event, two things are certain: *Courts* will be a source of controversy in SF fan circles and it will not be Zelazny's last visit to Amber. (H.Z.)....**The Craft of Science Fiction** Edited by Reginald Bretnor ($3.95 in paperback from Barnes & Noble). Within the breast of every science fiction fan, so the accepted tradition goes, beats the heart of a frustrated writer. Those legions of neo-writers, then, might welcome this book on the basis of its sub-title, "A Symposium on Writing Science Fiction and Science Fantasy". And, indeed, the aspiring author might feel he or she has come to the right place, to learn writing from the stellar cast of contributors that Bretnor—an excellent author himself—has assembled. Larry Niven, Poul Anderson, Harlan Ellison, and Frederik Pohl are but a few of names you'll find on the contents page. Writing, however, cannot be taught, as the editor states in his Forward. Not in the way that plumbing or nuclear physics can be taught, at least. While there are available books and courses covering the "nuts and bolts" of writing fiction—conflict, plotting, characterization, etc.—no book

In Print

can substitute for the experience necessary for becoming a writer; the trial and error. (Michael Banks). . . . **The Illustrated Book Of Science Fiction Ideas And Dreams** by David A. Kyle ($7.95 in hardback from Hamlyn). A companion volume to the author's *A Pictorial History of Science Fiction*, this book follows up on the development of SF with a fascinating examination of the concepts presented in SF. As with the previous volume, the author's extensive background in SF shows through in the richness of detail presented in this work, both editorially and graphically. Text and a profusion of color and black and white illustrations combine nicely here to provide the reader with an inside view of the ideas and dreams of SF writers and artists. (M.B.). . . . **Michaelmas** by Algis Budrys ($1.95 in paperback from Berkley). Domino started off as a simple device to avoid long-distance charges, but grew to connect with every data transmission device on and off the planet. Laurent Michaelmas is the leading newsman of the day and, together with Domino, he runs the world. Not overtly, mind you, but with the simple application of the right information in the right hands at the right time. At least they ran the world until the day they discovered someone else was playing the same game. This is a thriller that defies you to put it down. Very highly recommended. (Bob Mecoy). . . . **Miracle Visitors** by Ian Watson ($1.95 in paperback from Ace). In this captivating work, Ian Watson, award-winning British author, speculates that UFOs may not be a *logical* phenomenon. Psychologist John Deacon is studying human consciousness by using hypnosis to move subjects through differing states of consciousness. When he hypnotizes Michael Peacocke, he discovers a repressed memory of a close encounter. This revelation triggers a series of bizarre and frightening events that convince Deacon that there is a state of human consciousness able to invoke and control these happenings. People have reported strange things in the sky all down through history —Ezekiel's flying chariot, flying ships that got their anchors tangled in 13th-century church steeples, dirigibles that flew across the American midwest in the 1890s before any dirigibles existed, not to mention today's mysterious saucers. Deacon becomes obsessed with what he calls UFO consciousness, a force within all of us that creates these visions of future possibilities. His search leads him to Egypt and a Sheikh of the Sufis—a religious group that seems to be consciously working toward this level of awareness. Here he receives the startling insight that culminates this amazing and illuminating story. This book will challenge all your assumptions about those lights in the sky. (B.M.). . . .

Superman

(Continued from page 44)

Invention and creative extrapolation helped to solve the production's main problem: how do you get people to identify with and be sympathetic to an all-powerful super being? Donner's consistent answer throughout the film was to make Superman real—give him human problems. Donner and Reeve worked out a continuous process of discovery for Superman that extends from his childhood through maturity into his adult life. As a child in Kansas he cannot participate in sports for fear of killing someone—even tying his shoelaces without shredding them is a problem to be dealt with. When he asks his Earth father who he is, the answer is less than satisfying. Pa Kent cannot tell his adopted son where he came from, but adds that he isn't here "just to throw touchdowns." It isn't till he meets his Kryptonian father that he is made aware of his true status.

Reeve explains. "His father says, 'You must never reveal your identity to the world.' Why? 'Because people on Earth do not have the sense to protect their resources and your powers would be abused.' He goes on about the way people would be calling on him every two minutes to do things, also that his enemies would hurt him because of who he is. So he's left to his own devices to think up a disguise. He comes up with a newspaper office—why not? That's where you stay the closest to news of the world—disasters and news of that kind."

Reeve warms to the description of Superman's human persona. "He invents the whole Clark Kent personality, but he's not very good at it at first. We see him the first day on the job learning what you're supposed to do as a reporter, how to go on assignment and all that stuff; the first day he meets Lois; the first scene in Perry White's office. Then the next time you see him he's a little better at it, and then he becomes a damn good reporter. We tried to get away from things that are cut-and-dried and into the learning process. As he's learning to be Clark Kent, he's also learning how to be Superman. I think that discovery can be interesting."

Indeed, that self-discovery is at the heart of Reeve's portrayal. "I would say that what makes him interesting as a person is his openness, honesty and vulnerability. I think to see an honest person in motion is pretty interesting. It makes him sort of vulnerable because it doesn't work all the time. I mean," Reeve adds, "honesty doesn't get you very far."

Surrounding all of this honesty and human drama is a sea of spectacular special effects. Reeve thinks the SFX are terrific, but only as an element that complements the story. "This movie will make it," he says, "on the basis that it dares to combine a real story about people with special effects. In *Star Wars*. . . I really think it was a designers' and special-effects men's film. I think the actors took second place in that film." Reeve feels that the SFX and the acting have equal billing in *Superman*. "If you have mind-blowing effects on Krypton, ten minutes later you're on a farm in Kansas. Then, *zoom*! You're in a newspaper office in New York City (Metropolis). The variety in the film is going to please people. And the variety for an actor. . . . I got tremendous satisfaction out of doing Superman *and* Clark Kent."

Donner and Reeve worked hard on the dual realities of the film, making sure that each moment was true to itself; that Kansas was Kansas and Krypton a whole other world; that Superman and Luthor were larger than life and Clark and Lois real human beings. But every film can only have one ending—even though Donner came up with two.

The original ending called for an old-fashioned cliffhanger, with so much impending peril that Donner envisioned audiences screaming for the sequel to be shown even as the final credits were still rolling. But the film is filled with mind-boggling sights and Donner felt that by the end "you're conditioned to what he (Superman) can do." So Donner went with the movie's other major element. "The humanity of his last feat," Donner says, "is to me the biggest, grandest feat of the picture. It's a wonderful twist, as is the very last frame. . . . It occurred to me at the last minute and I told Chris and he reacted instantly to it. So we shot it.

"It's the ultimate up," Donner declares. "Visually it isn't 1/100th the spectacle you've seen earlier, but emotionally it's the biggest up in the film. That's the difference in what I've wanted to do in this film. It's not about other planets or earthquakes or nuclear bombs or superpowers. It's about people."

Christopher Reeve puts it this way: "What makes a movie work is the story . . . stories about people. That's what makes the world go around—people wanting to hear about how other people did it; how they lived, how they breathed.

"In the final analysis," says Reeve, "it's not the size, it's not the money; it's simply whether or not you've got a good story well told."

Now at the end of a long road, Donner has a chance to look back at what he's done. "There's still the spectacle, the humanity and the humor," he says. "Some critics will say, 'They went too far with the giggles.' Others will say, 'They didn't go far enough.' I feel we treaded a very thin line. . . but we mastered it."

Subterranean Swimming

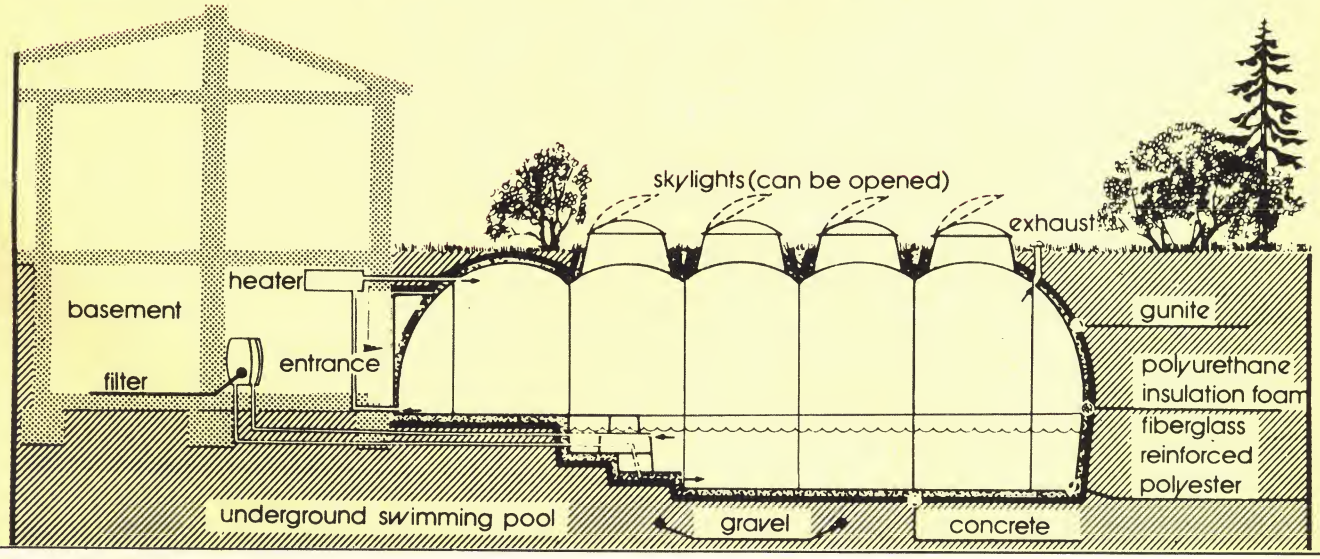
By Maderna Underground Pools
2 East Fayette St.
Baltimore, Md. 21909

How would you like to have a year-round tropical retreat right in your own backyard—or rather, *under* your own backyard? The Maderna swimming pool is the world's first modular underground pool—and some of its happy owners will argue that the $30,000-plus price tag is actually a bargain, since the space-age subterranean playground can be used no matter what the weather outside. In fact, it might be possible to build a conventional pool and enclose it for year-round use at approximately the same cost. But the Maderna's energy-efficient virtues will save considerable money on heating fuel bills. Built on the principle of a thermos bottle, with the surrounding earth functioning as natural insulation, the Maderna needs only one-third the energy required tc heat a conventional indoor pool.

The Maderna underground swimming pool is made of prefab fiberglass-reinforced polyester "elements" which are sealed and bolted together on the building site. A layer of polyurethane foam is sprayed on the outside of the shell to optimize the heat-preserving qualities. Steel-reinforced gunite (pressure-applied concrete) is applied to the outside shell to ensure strength against the earth pressure. All drains, water supply valves and air ducts are already built into the elements, enabling easy connection to existing facilities.

One of the modular units contains a whirlpool tub, a shower and steps into the five-foot deep pool. An optional module can provide a lounge and solarium area. The only part of the Maderna pool visible above ground are the skylights (choice of transparent or opaque), which can be opened from inside the pool by the touch of a button.

The Maderna comes equipped with an automatic filter system to keep the water crystal clear, and it also has a heat exchanger to keep the water at the desired temperature. With a water temperature of 79°F and air temperature of 84°F, combined with humidity of 65 percent. the Maderna underground pool is a reasonable facsimile of optimum weather conditions in the sunny Bahamas.



Inventors and manufacturers are invited to submit items. Forward information to David Hutchison, Science Editor, FUTURE, 475 Park Ave. So., NY, NY 10016.

Star Power: Kindling a Sun on Earth

Take two hydrogen atoms and bang them together. What did you get? Just two hydrogen atoms, nothing else? Well, you just didn't use enough force.

Now try it again, but slam the two atoms together *hard* — as hard and fast as a temperature of 100 million degrees can move them. And don't use ordinary hydrogen. Use deuterium and tritium, the heavy and superheavy isotopes of hydrogen.

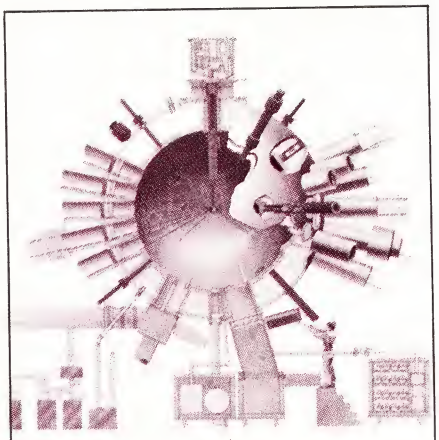
This time something happens — an event which could light a sun on Earth!

The atomic nuclei of hydrogen fuse into each other. They turn into a helium atom and a neutron. Between the two of them, these products are carrying away more than 17 million electron volts (MeV) of energy liberated by the reaction, incredibly much more energy than you used in slamming them together. The neutron is carrying the lion's share: 14.1 MeV. Where did that energy come from?

What has happened is called thermonuclear fusion: the combining of two of nature's lightest atomic nuclei to produce a larger nucleus. This nucleus is strangely deficient; its mass is less than the sum of the two smaller masses. The difference has been converted into energy according to Einstein's famous formula, $E = mc^2$, which established that mass and energy are equivalent, connected by a proportionality factor that happens to be the speed of light.

Today's atomic power reactors make use of the opposite process: nuclear fission, the splitting of large, heavy atoms into lighter, medium-size nuclei while liberating part of their binding energy. Developing in the laboratory the process that powers the stars has turned out to be far more consumptive of talent, time and money than anyone would have predicted 20 years ago, when the challenge of creating an unlimited energy source was first taken up in earnest. As a consequence, fusion research has always lagged far behind fission technology despite its immensely alluring promise of safe, clean and limitless power. Recent developments, however, seem to bring that promise finally within our reach. When all is said and done, controlled thermonuclear reaction (CTR) will be the last best hope of an energy-starved humankind.

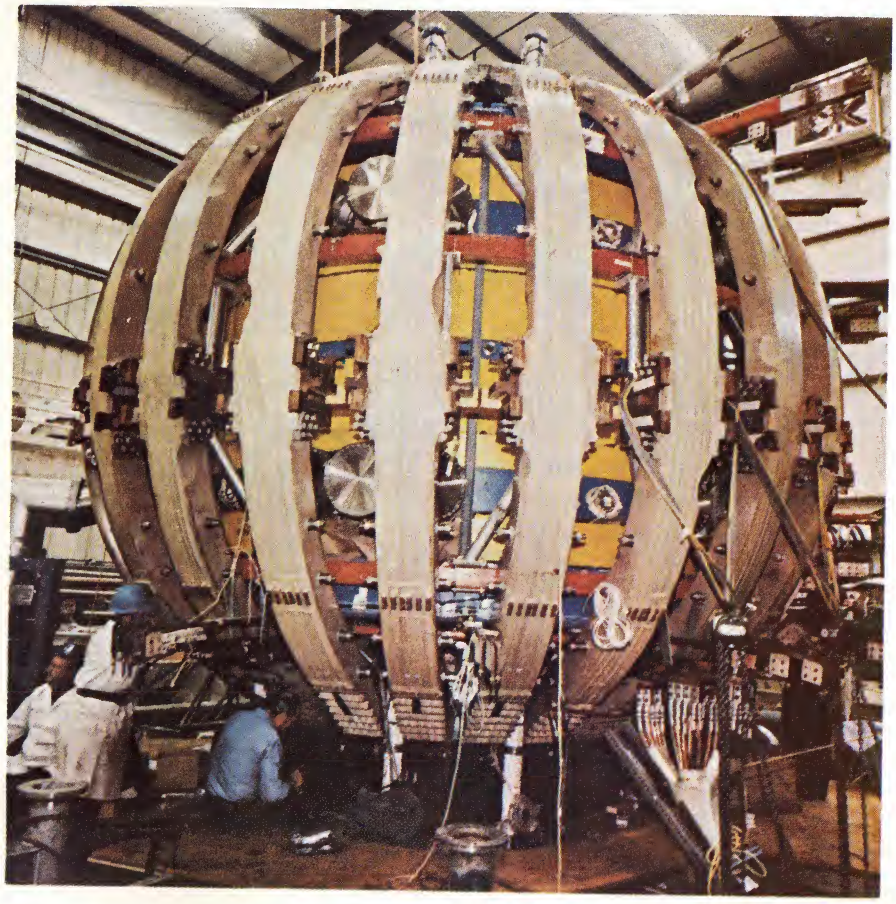
The reason for the difficulty in getting the nuclei to fuse is that they both carry a positive electrical charge, strongly repelling each other. To overcome this repulsion, the particles must be brought together with vast force, i.e., high kinetic energy. But if that were the only critical factor, we would have no problem. Any respectable nuclear physicist with a particle accelerator could create such energies with relative ease. Unfortunately, since with fusion there can be no chain reaction as in fission reactions (example: the A-bomb), the hit-or-miss fusion in the accelerator would remain a rare single event without useful energy surplus. Only when enough particles are packed together tightly enough for a sufficiently long time and high enough temperature can the fusion process yield a net energy



Cross-section of Nova target chamber where Shiva's lasers are aimed.

Below: Shiva's giant lasers (note man for scale). Opposite: General Atomic Company's new Tokamak reactor.

PHOTOS: U.S. DEPARTMENT OF ENERGY



profit, as demonstrated by the H-bomb. These extreme conditions require the hydrogen to be in the plasma state, as an ionized gas, but to maintain this under controlled conditions poses formidable problems. Tackling these obstacles is one of the foremost challenges of high-temperature plasma physics and engineering.

Of the more than 30 known nuclear reactions that release more energy than they consume, the deuterium-tritium process is exceptionally profitable: each gram of fuel yields about 90,000 kilowatt-hours of energy. The least demanding technically, it also has by far the lowest "ignition temperature" of the fusion reactions possible in a reactor — but even this temperature still amounts to a staggering 100 million degrees. At that temperature, net power would be produced if 10^{14} (that's 100 trillion) nuclei are confined in one cubic centimeter of space for one second. This measure is the "Lawson Criterion" (after British physicist J.D. Lawson). But do you confine and compress a gas that could instantly vaporize any solid material container?

To date, we know of two techniques: one is the use of strong magnetic fields. Another, more recent, is called inertial confinement. In the future, there may be others.

Ensnaring the plasma in magnetic traps or "bottles" works because plasma particles, due to their electrical charge, have a hard time diffusing through magnetic fields in directions that cut across the magnetic field lines. The desired compression effect is then obtained by *pinching, pulsing* or *twisting* the field. These approaches are used in three concepts. There are the so-called "mirror" machines which use ion beam injection and strong magnets to reflect the charged particles back into cylindrical or spherical plasmas. High-density pinch reactors apply sudden squeezing (pinching) forces to the ends of tube-shaped plasma regions. And from Russia with promise come the formidable Tokamaks, closed devices with doughnut-shaped magnetic fields, named after the Russian acronym for "toroidal magnetic chamber."

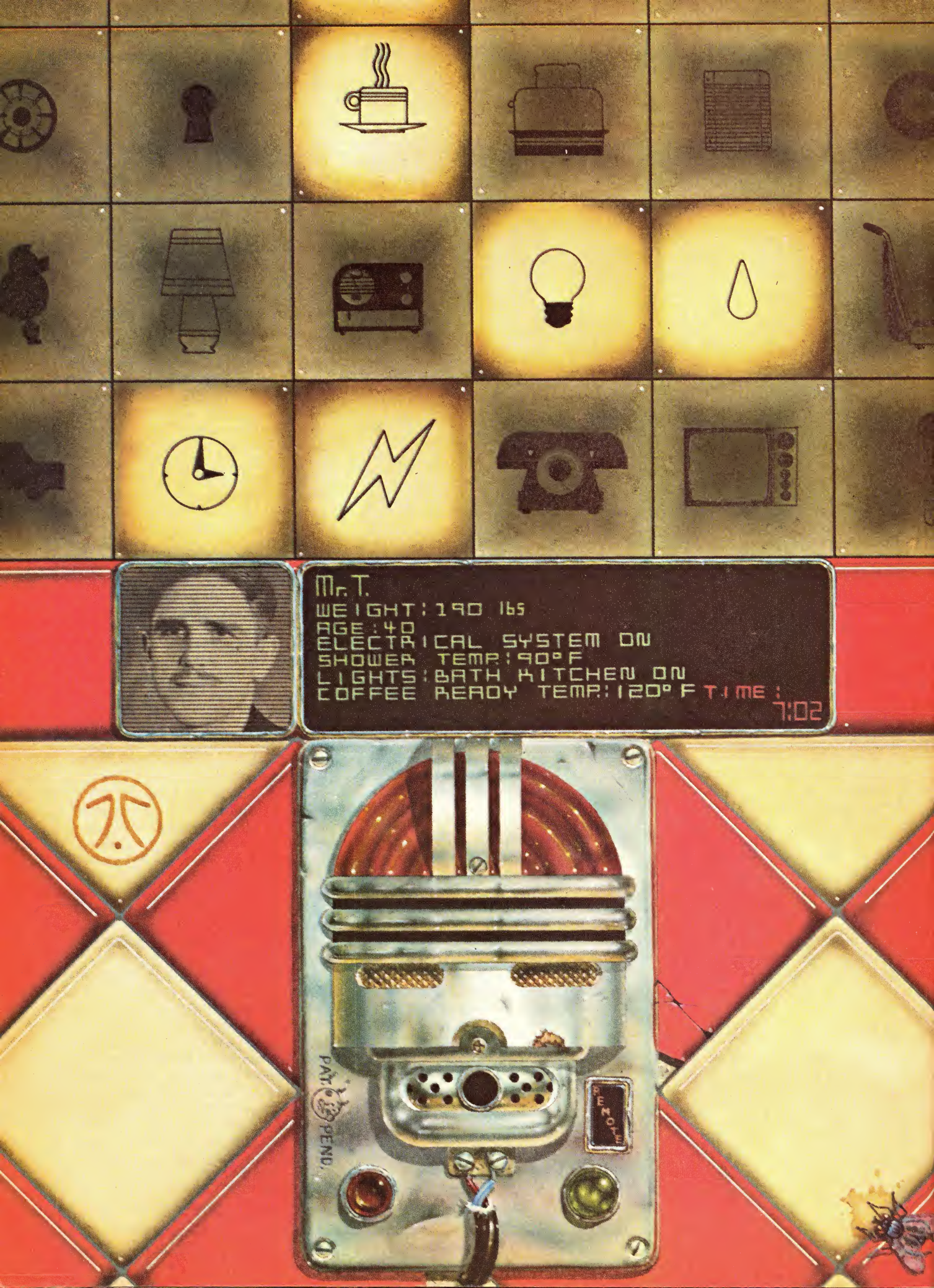
The development of these three concepts has reached such an advanced state of sophistication that the heating and containment of the plasma at the required Lawson Criterion could be achieved without much trouble if it weren't for one vexing difficulty: magnetic bottles are not absolutely plasma-tight. At high temperatures and densities, hot plasma tends to break out of the magnetic traps, either in parts or as a whole. This strange behavior is caused by plasma instabilities — very small incidental disturbances of the otherwise highly ordered motion of the hot plasma particles that can trigger overall catastrophic disorder. Like some berserk King Kong escaping from his cage by bending and twisting the steel bars apart, the hot plasma simply pushes the magnetic lines aside and escapes — to be instantly "quenched" into a cold gas. These "micro-instabilities" cannot be explained by the classical equations of fluid mechanics and, therefore, researchers cannot predict what will happen at higher temperatures.

Thus, there has been great anxiety among fusion research scientists that micro-instabilities would become rampant at the high temperatures they are shooting for. But now, all of a sudden, there comes word of a knowledge breakthrough and new hope from the Plasma Physics Laboratory of Princeton University. The U.S. Department of Energy (DOE) announced in August 1978 that Princeton scientists, working on the three-year-old Princeton Large Torus (PLT), a monstrous Tokamak-machine, have achieved controlled deuterium-deuterium fusion reaction at a temperature of 60 million degrees—four times hotter than the Sun's interior. While the plasma density was intentionally kept way down, enough neutrons were produced (about seven trillion for each plasma discharge) to yield about one percent of the energy which had gone into the two-megawatt beam of deuterium atoms that ignited the discharge. What's more, reaching the 60 million degrees was surprisingly easy, and ... there were none of the feared instabilities.

While the magnetic confinement schemes are currently more developed and better understood, inertial confinement is an alternate concept which may prove to be easier and more practical. Instead of requiring powerful superconducting magnets for containment, the idea is to compress tiny pellets of fusion fuel almost instantaneously (in picoseconds—trillionths of a second) to densities 10,000 times that of normal solids, by imploding them symmetrically with the titanic sledgehammer

(continued on page 74)

Jesco von Puttkamer is Program manager of Space Industrialization and Integrated Long Range Planning Studies at NASA. He is also the technical advisor for Paramount's forthcoming Star Trek *movie.*


Mr. T.
WEIGHT: 190 165
AGE: 40
ELECTRICAL SYSTEM ON
SHOWER TEMP: 90° F
LIGHTS: BATH KITCHEN ON
COFFEE READY TEMP: 120° F TIME:
7:02
PAT. PEND.

The Computerized House Of The Not-So-Distant Future

The microprocessors of today are spawning the electronic servants of tomorrow.

By IVAN BERGER

Live-in servants went out with Grandpa's day—and too many grandpas couldn't afford to keep them anyway. But there may be a domestic helper in your future yet! Someone (or something) to wash the dishes, plan the meals, have breakfast ready in the morning...even help the kids with their homework.

Advances in microprocessor technology —the "computer on a chip"—are leading us toward the day when our very houses can be wired and programmed to do our every bidding. The micro-computer's impact on household chores may not be obvious quite yet, but that's because we still think of computers as devices that compute. In the house of the future, we'll use computers in a different way: for data processing and controlling processes.

Let's look at what these microprocessors could do in a typical home today, using only technology that's more or less available (if not always practically priced):

It's 7:00 a.m. An alarm goes off in the ceiling, spreading its sound in a tightly focused beam aimed at the region of the bed where Mr. Typical American (We'll call him "Mr. T," for short) can hear it. (A similar beam, aimed at the head of Mrs. T, will go off in 20 minutes.) It's followed by a gentle, but insistent voice calling, "Wake up, Mr. T! Time to get up! The time is 7:02 already..." Gradually the voice gets louder, till he sits up with a groan; then it stops—ready to resume if his head hits the pillow again.

Meanwhile, the coffee starts.

As he walks into the bathroom, the shower starts running. Stepping up to the sink, he places his feet on the solid-state, strain-gauge scale platform built into the floor. "One hundred and ninety pounds?" It must be Mr. T, since no one else in the family comes within 15 pounds of that weight. Knowing that, the computer system calculates the temperature at which to set the shower. But first, as Mr. T blearily brushes his teeth, a liquid-crystal display in the mirror tells him what day it is, what time it is, how today's weight compares with yesterday's, last week's, last month's and last year's—which then reminds him that his shower's ready.

In the shower, he senses it changing gradually from a relaxing warmth to a slight, stimulating chill—the rate of change dependent on his schedule, and on how many others in the family are up and waiting for the bathroom. As he steps out of the shower, warm air jets dry him—and de-fog the mirror—while the hot water in the sink starts. The computer knows that Mr. T, alone among his family (for now), will need to shave. In a few years it'll have to be told to do the same for T, Jr.

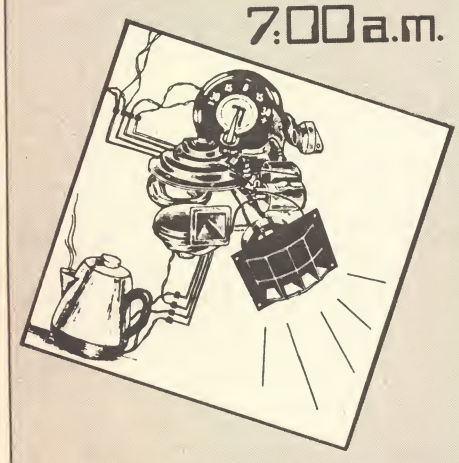
Had he the deluxe system, Mr. T would find his coffee already in the cup when he enters the kitchen, with just the amount of milk and sugar he wants. Yet even his

simple system has the computing power to do it—but the hardware to pipe in the milk from the refrigerator and chute in the sugar from a solenoid-controlled hopper is too expensive for such a trivial purpose. And before he's had his coffee, Mr. T is in no shape to regret that missing extra touch of luxury. Mrs. T is up by now, and coming in to pour her fresh-brewed coffee; the computer knows she won't take her shower till after breakfast.

Ordinarily, Mr. T would exit through the kitchen door and head for the garage. When he got there, the garage door would open and—once the computer had checked that the door was safely open—the car would start. Today, however, he heads out the front door to wait for an office colleague who will pick him up for an early client call. As he nears the door, the computer beeps and the door-side display asks, "NOT USING CAR?" Mr. T needn't answer—it's merely a reminder, just in case the break in his routine was inadvertent. Holidays and other breaks in the routine are programmed in advance into the computer's schedule store—the program that acts as the family's social secretary.

That's the program Mrs. T consults once her husband and kids have left, her shower's been taken and the second pot of coffee has been brewed for her. Today she'll have to pick up her daughter at school and take her to a dancing lesson. On the way, the computer reminds her, she should stop at the shopping center to pick up a present for her son's birthday later in the week, and an anniversary card for the

7:00 a.m.

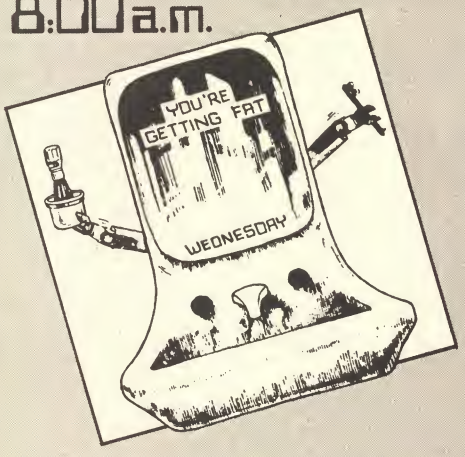


neighbors. While she's at it, it would be a good idea to do some food shopping. But before printing out a shopping list, the computer wants to know if there's anything special she has in mind for dinner. Searching its recipe file, and asking how many will be at the table, the computer adds any missing ingredients to her shopping list.

The computer has many ways of knowing what should be on that list. Its main source of information is a network of laser bar-code readers like those at supermarket checkout counters set into each kitchen-cabinet door. Put away a can of soup, and the universal product code printed on the can tells the computer what to add to the inventory. Take out a box of spaghetti and the computer will subtract that. Little by little, the mechanical menu planner learns the family's patterns of consumption and adjusts basic inventory requirements accordingly.

But it has other sources of information,

8:00 a.m.



too. One is the calendar: it orders more lemonade and less hot soup in summer. Another is the family's private calendar/appointment program: more milk is suggested when the kids will be home from school on holidays, more of everything on the menu when guests are expected for dinner. Sensors elsewhere in the house monitor consumption of everything from heating oil to darkroom chemicals to toilet paper.

The house got a major cleaning yesterday, so Mrs. T decides today would be a good day to pay the bills and do the accounts. Some of those bills have been paid already, by direct Electronic Funds Transfers from the Ts' bank to the bank accounts of their creditors. But a few other bills have come in the mail the old-fashioned way. Mrs. T keys them in, preparatory to having the computer print the checks and update its log of the family finances. Don't pay that bill from the department store, the computer tells her—Mr. T paid it last week, but his check must have crossed the statement in the mail. The utility bill checks out with the family's actual gas and electricity usage, and the computer has paid that, via EFTs, already. But the phone bill has several unfamiliar-looking long-distance numbers. Punching those in, Mrs. T gets an instant playback of the names belonging to those numbers, helping her earmark the business calls for which Mr. T's company should reimburse him, while the computer confirms that the calls were actually made from that phone.

By now, Mrs. T has also loaded the dishes and laundry into their respective washers, and has pushed the buttons to turn the machines on. But neither washer is running—the computer, checking its table of power rates for different times of day, has decided that it will cost less to do the wash at night when the electricity rates are lower. If company were coming, though, it would do dishes—but in this case it knows that enough clean dishes are left for the family's dinner.

The lawn, the computer senses, is a little dry, but it won't turn the sprinklers on: it's been told to conserve water during the current drought—and besides, its connection with the local newsbank tells it that rain's expected in a day or so. As well, when that rain comes, the computer will sense from which direction it's blowing and alert the family to close any open windows on that side of the house. (The hardware to close the windows automatically is, again, a bit beyond the Ts' budget.) However, if the rain doesn't come, the lawn will be sprinkled—but just enough to ensure its survival; each individual sprinkler will shut off as soon as its area of lawn has had enough.

Later in the day, shortly after Mrs. T leaves the house, her youngest son comes home from school. He's too young, the Ts feel, to be trusted with his own house key—but he doesn't need one. "Who's there?" the computer's audio response asks as he steps on the doormat.

"Johnny," he says. Comparing his voice, weight and height with information in its memory, the computer decides that it probably is Johnny...except the weight seems a bit high. "Are you carrying anything?" it asks. "If so, please put it

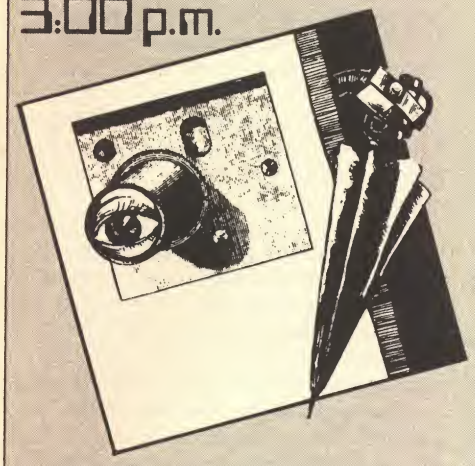
11:00 a.m.

down." Johnny dutifully sets down his school bag, and the weight discrepancy is solved. The door unlocks. Just as Johnny steps inside, the computer reminds him, "You left something." The schoolbag's weight had not been re-added. In winter, of course, everybody's registered doorstep weight will be adjusted upwards to compensate for the heavy clothing. In the children's cases, their registered height has to be increased frequently, too.

Johnny only stays a few minutes—he's been invited to a friend's house around the

corner, and will stay there for supper. He types a note to that effect on one of the keyboards strategically installed around the house. Despite his spelling "supper" with one "p", the computer knows to reduce its supper recipe quantities to account for Johnny's absence. But just to check—and to help Johnny with his spelling—it asks him, "Don't you mean 'supper'?" Johnny hits the "yes" key, and leaves.

3:00 p.m.



The house is getting warm now; the air conditioner was turned down a bit before Mrs. T left. But Mr. T will be home in a few hours. Is it time to turn the cooling system up again? Checking the interior and exterior temperatures, and cross-referencing its log of temperature changes over the past few hours, the system decides it would be less expensive to turn the air conditioners back on full blast when the lower, evening power rates come on, rather than to start cooling gradually now. With different weather, though, it might be cheaper to start now. If the outside air gets cool enough, the air conditioner will shut off entirely, and an intake vent will suck in cool, fresh air from outside. If the T family suddenly decided to go out for dinner and a movie, that information could be dialed in from any Touch-Tone phone, allowing the air-conditioner control program to save still more on power.

But tonight everyone is home. The computer screen in the kitchen is, for the moment, devoted to recipes, telling just when everything must be done in order to have all the items on the menu cooked within a minute or so of one another. Two dishes use the oven, but for different times and temperatures. The computer figures out a compromise setting suitable for both, and tells when each should go into the oven for its readjusted time span. Nutritional suitability is checked, too: tomorrow the computer will suggest a menu a bit heavier in "A" vitamins, since today's meals are a little short on those.

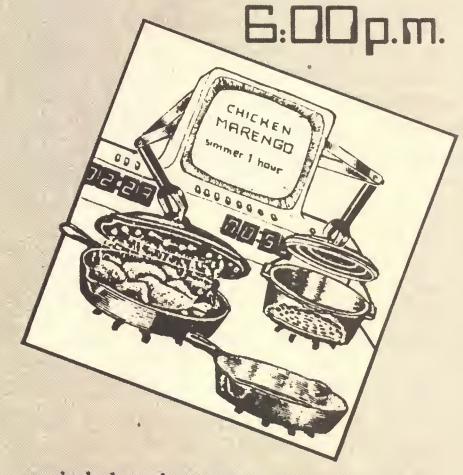
After dinner the computer waits for the dirty dishes before activating the dishwasher. Dad settles back to read his evening headlines...as they flash by on his console screen. Some stories he flags for a quick reading of the subhead and lead paragraph, a few he requests in their entirety—most of those are printed out on a separate paper, since Mr. T hates to read long copy from a screen.

Johnny is doing addition and subtraction drills on his screen, using an instructional program supplied by his teacher. His scores and an analysis of any consistent weaknesses in his approach are re-recorded on the program card for the school's records, and printed on a sheet his teacher can later read.

His sister, meanwhile, is consulting the encyclopedia data bank at yet another terminal. Books are still more enjoyable in standard book form than as images on a screen; but short-entry reference books are more convenient as data banks, with instant accessibility and infinite "tree" structures of cross-referencing. Unlike earlier programs, which were more efficient, this one permits a bit of browsing, showing a random sample of subsidiary headings as it scans its way toward the topic called up. A lot of extra learning is done that way. T Jr. is doing an assignment in Current Events, so he's consulting a distant library data bank that's updated daily. Next week he'll have a report to do on the Middle East, so he's told the computer to save every story on that area for the next seven days.

Mom's at a terminal, too, typing out a letter to her parents. Using the same word-processing program that her kids use when typing up their school reports, she gets her note into letter-perfect form. But that

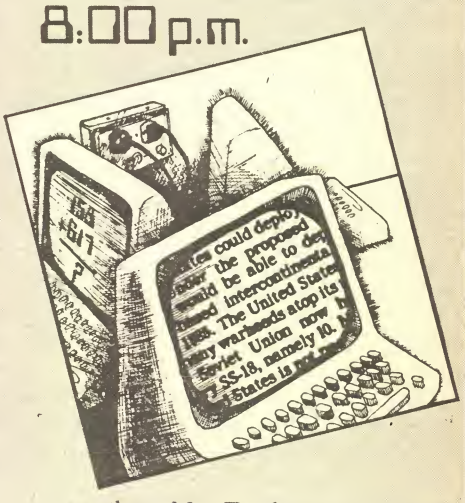
6:00 p.m.



reminds her she owes a note to an aunt, too. Since some of the information in the letter to her folks would be of interest to her aunt as well, she copies those paragraphs verbatim, using just a keystroke or two. Then she changes a few words, deletes a sentence that she doesn't want her aunt to see and adds a few personal paragraphs. Both letters will be typed out, ready for her signature tonight. But if her folks were less old-fashioned, with computer systems like the Ts', the message would be sent at high speed—via a short, inexpensive, late-night phone call—to her parents' terminal, where it would await them the next morning.

Once the day's work is done, Mrs. T joins her husband in the living room, and their topic of conversation turns to music. They both vividly remember a soprano they heard in an opera last year and would like to play a record of hers. But alas, the name of the opera and the soprano both

8:00 p.m.



escape them. Mrs. T pokes at the chairside keyboard, then sings a snatch of an aria from the opera. She's not that good at it, so the computer comes up with three possible identifications of the tune, which it displays on the screen. That jogs their memory enough so that Mr. and Mrs. T know just which opera it was. Then they ask for the names of the sopranos in the last performance they saw. It turns out that their memory was somewhat at fault—the opera was the year before last, and the singer they're thinking of was a mezzo. But knowing her name at last, they can find out in a jiffy just which recordings they have by her, and where those recordings are shelved. They have time to hear two arias before going to bed.

Everything predicted here has been possible with standard computers for years. But only in the last year or two have computers been available which are small enough and cheap enough to be practical for home use. Most of the systems mentioned could be built inexpensively if incorporated into the construction of a new house. The hardware to perform most of those functions already exists, though not much of it is yet packaged and sold for home use. The programs to run all these functions have not yet been written, but they easily could be, often by rewriting programs which do exist.

What's wrong with this prediction, then, is not that it's too futuristic, but that it's far, far too conservative. Even the simplest labor-saving appliances have already changed our lifestyles tremendously.

How much more could our lives be changed if such servile computer systems became common in our homes? Much of

Future House

the work we now do at schools and offices could be conducted from a home terminal. (There goes Mr. T's daily drive to work—and perhaps his daily shave as well!) That means the family could well find themselves at home simultaneously a good deal of the time. . . although not necessarily "at home together." The multiple activities available at the family's many terminals could prove even more divisive and isolating than families find multiple TV sets now.

There is also the danger that computers with data links to the outside and full control over the home's operation could be manipulated from somewhere besides the home. A practical-joking neighbor who could crack the (presumably standard) instruction code, could fire off your lawn sprinklers whenever he saw someone crossing your front walk—or reprogram the computer to do it whenever someone stood on the doormat.

Plenty of kinks are bound to crop up on the road to the totally computerized house of tomorrow. But the prospect of an omniscient domestic servant holds plenty of appeal for the anti-housekeepers among us.

Who could object to a future in which, instead of taking care of the house, the house takes care of you!

Stella Star

(Continued from page 55)

production finally came to a halt. I had completed my first SF movie.

With *Stella* now in the can, all I can do is wait and hope for its American debut. I have no idea in what form U.S. audiences will see it. My name was changed to "Lewis Coates" for the English version because the producer wanted to sell the movie as an American production. It isn't. It's 100 percent Italian. Only the six main actors and the producer are from abroad. Now the producer tells me that he is going to handle all the American dubbing himself. He wants to add a "comedy feel" to the movie. God save it!

If Stella succeeds, I'd like to go ahead with two independent SF films, designed as semi-sequels: *Star Riders* and *Sky Blue, Star Pilot*. I'd also enjoy filming Van Vogt's *The House that Stood Still*. I'll do my best to realize all my cinematic science-fiction dreams. Everything rests with *Stella*. If she makes it big at the box office, I'll go on to part two and three. If not. . . well, who knows what the future will bring. I suppose if I could survive the making of *Stella Star*, I can film my way through anything.

Science Notebook

(Continued from page 69)

force of converging pulsed lasers, electron beams or heavy-ion beams. The resulting density and temperatures are high enough to trigger the release of fusion energy before the internal pressures have time to overcome the pellet's inertia and blast it apart.

The largest of these laser fusion machines, packing the world's biggest laser, is the awe-inspiring Shiva system at California's Lawrence Livermore Laboratory. Like the Hindu god of destruction and creation, Shiva is a multi-armed creature, but with its 20 parallel laser-amplifier chains, each almost 10 inches thick and 200 feet long, it outflanks its four-armed namesake. Its first successful experiment, in May 1978, produced 7.5 billion neutrons. Designed to deliver a whopping 30 trillion watts of optical power (almost 60 times the installed electrical generating capacity of the U.S.) in less than a billionth of a second, the neodymium-glass lasers will nevertheless produce only about 10 percent of the energy which went into the lasers. It will take Shiva's planned successor, mighty Nova, to achieve the conditions needed for a net energy gain from fusion; 30 times Shiva's energy and 15 times its power.

In fusion power, there are three development milestones: **scientific feasibility**—the achievement, in laboratory devices, of fusion conditions that would give an output power exceeding the input power in an operational reactor; **technological feasibility**—the actual building of such a device capable of sustaining continued safe operations; and **commercial feasibility**—the provision of fusion energy in commercial competition with other energy sources.

Not even the first stage has been reached yet. But after the recent successes, hopes soar high that at least that first milestone will be achieved in as little as three years, perhaps first on Princeton's giant new Tokamak Fusion Test Reactor (TFTR), due to go on full power in early 1982, or with the Common Market's huge Joint European Tokamak (JET) in England, or by the even larger Tokamak-20 (T-20), planned by the Soviet Union.

There are a number of *formidable* engineering difficulties that have to be overcome before technological feasibility is achieved: the handling of radioactive tritium, the protection against fast neutrons and problems of reduced useful lifetimes of vessel materials due to neutron bombardment. But in a report published in 1976, the Atomic Industrial Forum Committee on Fusion concluded that the technology to meet the operational requirements is available and that fusion plants will be able to meet all environmental and safety requirements.

So, when will electricity be generated by thermonuclear fusion in the U.S.? Predictions range from 6-25 years in the future. In the latter category is the opinion of DOE's research office which puts the date of operation of the first commercial fusion reactor at 2005 and foresees at least three, possibly four or five commercial power plants in operation by 2025. On the other end of the forecast spectrum is a controversial proposal of a "throwaway" mini-Tokamak called Riggatron, promoted by International Nuclear Energy Systems Co. (INESCO) which, it is claimed, could be operational by 1985.

In any case, the promise held out by thermonuclear fusion as the ultimate energy source for humanity is immense—as mind-boggling as lighting a sun on Earth. Its fuels are cheap and abundant. Deuterium exists naturally in sea water, making every gallon of water on Earth the potential energy equivalent of 300 gallons of gasoline. Tritium can be produced from the metal lithium, known reserves of which will last for at least 50,000 years. Ultimately, even lithium would become obsolete as fusion reactors would draw all their power from the inexhaustible oceans of the world, and energy is harnessed from advanced fusion processes, such as the proton-boron-11 reaction, that eliminate neutron fluxes and their radioactivity problems. And, if placed in Earth orbit during the coming era of Space Industrialization, space-based fusion reactors would be totally removed from the biosphere, helping themselves freely to the unlimited vacuum of space for vastly improved plasma containment.

Make no mistake: fusion is not just one possibility but an entire new world of energy possibilities. Like solar energy, it offers a variety of different options—some easier to achieve technically than others, many with very attractive environmental characteristics and all of them better than fission in many regards.

The vision for fusion power also includes breathtaking new uses not involving electric power generation, from the "fusion torch" for total recycling of waste materials into pure elements or for plasma-chemical processing of industrial products to fusion propulsion for large ships and aircraft. The real foundations of the great civilization of the future are being laid by the fusion research advances of today—a civilization founded on star power.

But that's only half of it: controlled thermonuclear fusion may one day power people of Earth to the stars. For it alone offers specific impulses and thrust levels of the magnitude that will bring those high voyages through interstellar space into the realm of feasibility.

The stage is dark and the audience waits in anticipation. But wait—not entirely dark. Tiny pinpricks of light—blue lights, red lights—can be seen, dimly indicating the presence of banks of machinery stretching the width of the stage.

There is no fanfare, no announcement, but if you watch closely you can see momentary silhouettes moving before the tiny lights: the figures of the musicians moving into place. Then, suddenly, magnificently, a blast of sound wells out and the audience is swept with enthralling music—great sweeps of sound punctuated with complex rhythms as if from a multi-man rhythm section. The effect is the same—if not more glorious—as if a large orchestra had burst forth into sound. But as the stage lights rise from stygian blackness to a dim murk, it becomes obvious that this "orchestra" consists of only three people, each of whom sits or stands, back to the audience, before his own individual bank of machinery. The one in the middle is the "rhythm section"; he feeds riffs into pre-programmed sequencers—although in the course of the concert he will reprogram often, for more complex rhythmic patterns.

The time is now. The group is the popular German synthesizer trio, Tangerine Dream.

* * *

When we consider the future of any form of entertainment we have to go out on a limb. There was no way that either the popular musicians or their serious counterparts at the turn of this century could have predicted any of the notable musical developments of the past 79 years.

There are two basic reasons for this, only one of which is the dramatic way in which technology has influenced the music industry over the past two decades.

Basically, the evolution of any art form —music, writing, acting—is pegged on the evolution of individual artists. Without Louie Armstrong, the entire course of jazz would have been different; he, more than any other single musician, took jazz away from the collective improvisations and group ensembles of New Orleans "Dixie" jazz and made it a soloist's art. That was 50 years ago. And where would rock and roll be today if Elvis Presley had remained content to drive a truck after recording a few demos in the Sun studios? The basic music was already there, but might it have collapsed in the wake of subsequent musical fads like bossa nova (anyone remember "The Girl from Ipanema"?) without the huge commercial success of a Presley?

Indeed, where would rock music be today if the Beatles had become discouraged by the long hours and low pay in Hamburg in 1961? By the early 60s the original impetus of the music generated by Chuck Berry and Little Richard and, yes, even Bill Haley, had pretty much dissipated. Commercial recording interests saw little that was desirable in the fragmented small-label rock-and-roll business —and none foresaw that 15 years later rock would be the biggest money-maker in the recording industry.

It's impossible to predict the advent of an individual whose talent may galvanize an aspect of the entertainment field, totally revitalizing, reforming or recreating his chosen area.

Yet there are broad cycles which, if they don't *manufacture* the success of a new artist will at least give him maximum opportunity for success.

The success of the Beach Boys and the Beatles was also the success of rock's second generation: kids who grew up on Haley, Berry, Presley, et. al., began to form groups while still in junior high school, and—after playing their own versions of their favorites—began to create new music. Rock and roll was in fact the "folk music" of the 60s—far more so than the pallid works of the Kingston Trio or Peter, Paul & Mary. Everyone had friends who rehearsed in their parents' basement or garage.

The instrument of choice was, without doubt, the guitar. But not the folkies' acoustic guitars. Rockers went for the amplified guitar—a Telecaster, a Fender or a Les Paul Gibson. Link Wray's "Rumble" was their anthem: thick chords, heavy sustain, plenty of reverb. Three guitarists could generate as much volume and texture as a small orchestra. Throw in a drummer and you had your basic group.

Rock in the 1970s has evolved considerably and in a variety of dissimilar directions. Commercial rock has become, to quote Captain Beefheart, "as safe as milk." A big-bucks medium, it has reverted, to a surprising extent, into the hands of recording industry executives, the producers who are known for their track record of producing hits. Rock musicians of the 60s have either continued their individual growth and development as artists and found themselves isolated from the mass media as cult heroes, or have backslid into complacent commerciality, making the transition from rock revolutionaries to accepted entertainers.

But the lesson we've thus far learned about rock is that it is a music of raw vigor and vitality. How can this be reconciled with complacency and a Beverly Hills house with swimming pool?

As the pop music industry assimilates yesterday's rock into today's muzak, a new generation is gathering its strength for a renewed assault on the establishment. In Akron, Ohio, groups like Devo, Pere Ubu, Jane Eyre and others are rising out of bleak working-class backgrounds similar to the industrial environment which spawned the brief-lived punk rock in England.

Social conditions change; nothing in our culture is static. But with allowances for the fact that the 70s aren't *really* a replay of the 50s—it only feels that way at times —it's a safe guess that the rock cycle will continue. As last year's model becomes bloated and commercially safe, lean and hungry new revolutionaries will find their moment at hand. The extent to which any of these newcomers will be successful will

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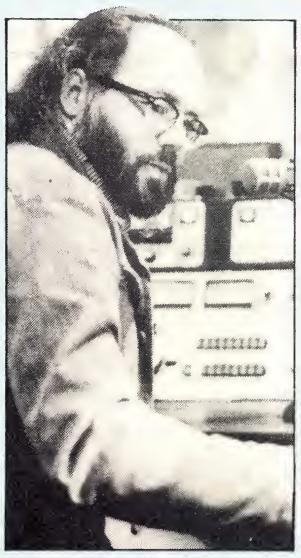

White

Ted White is known to the science-fiction world as the author of more than a dozen SF novels (Secret of the Marauder Satellite *and* Forbidden World, *written with Dave Bischoff, are currently in print), and as editor of the world's oldest SF magazine,* Amazing Science Fiction *(and its sister publication,* Fantastic*). White began his career 20 years ago as a jazz critic, and acted as midwife to the birth of rock criticism in 1966, when he published the first issue of Paul Williams'* Crawdaddy *on his basement mimeograph. His current consuming interest is European progressive rock, and he can be heard on Friday afternoons over radio station WGTB-FM, 90.1, in Washington, D.C., in the guise of Dr. Progresso.*

remain a function of individual talent... and that is totally unpredictable.

Recently in the course of an interview with Washington, D.C., synthesizer wizard Rupert Chappelle, the subject of the future of synthesizers came up.

"Don't you feel a little uneasy about working with these machines?" Chappelle was asked. "Doesn't it make you feel a little like a cyborg—like you're becoming part of a machine?" There was a laughing side-reference to the German group, Kraftwerk, whose latest album is titled *The Man-Machine.*

"No," Chappelle replied. "The reverse. I feel that the synthesizer *frees* me from becoming a machine. Think about it: when you pick up a guitar and play, you have to teach yourself to become something of a machine. Your hand learns how to become machine-like, so that you can maintain those even rhythms. An awful lot of music is *work*—hard work. Synthesizers are liberating. You can let the machine do the hard work."

Chappelle predicted that within the next few years the synthesizer would replace the guitar as the basic instrument in rock. And he pointed out the specific direction this would take: "Right now you can buy a computer chip—an integrated circuit—that is a complete synthesizer... for *three bucks!* Radio Shack has it. That chip has all the basic circuits for a complete synthesizer—all you have to do is add the controls, which might cost you another hundred bucks. Can you imagine what kind of impact that is going to have?"

It's not hard to imagine. The technology of synthesizers is intertwined with the technology of computers, and both are tied into the space program. In the 50s we didn't have the booster technology to orbit payloads as heavy as those being orbited by the Russians, so we explored the possibilities of miniaturization. Out of those early technological explorations have come a cornucopia of benefits, only one of which is the three-dollar synthesizer chip. One more serendipitous reason for the continuation of the space program, by the way—it has a way of spinning off the most fascinating and unexpected dividends.

Will future rock stars have to lug truckloads of machinery from concert to concert? That's doubtful. The setup used by Tangerine Dream would have filled the entire concert hall if it had existed in the early or middle 50s—when electronics still relied on the vacuum tube and the transistor was still in its infancy. And it would have generated vast amounts of heat. That heat represented wasted energy, and would have required a vast power source as well as mammoth backup cooling systems, themselves an energy drain.

The machinery which fills a stage today will fit into a suitcase or two tomorrow. The bulkiest part will be the controls—keyboards and switches. Right now the adventurous can buy synthesizer kits which are powered by flashlight batteries. Soon synthesizers will be no larger than today's hand-held calculators.

Presently, synthesizers are "stupid"—they have little capacity to generate more than what one tells them to do: they are no more capable of innovating from their input than a piano. But already synthesizers employ logic sections, the first step towards computer interface. Computers can be programmed imaginatively with "either/or" instructions. The interface between synthesizers and computers exists now and will be much more fully exploited in times to come.

* * *

The stage is dark, and the audience waits in anticipation. A spot of light focuses on the center of the stage and grows. Soon the audience can see four musicians standing or sitting on the open, bare stage. One musician has a keyboard slung with a strap around his neck; another is holding something that looks like a pocket calculator. The other two appear empty-handed. They look at each other and the leader nods.

Suddenly, the hall is full of music. The sound seemingly comes from the entire stage with no visible source. The musician with the keyboard occasionally runs his fingers over the keys, but there is no apparent correlation between his finger movements and the music. One of the others—who appears to have no instrument—moves his arms in sweeping circles, and the musical sound sweeps across the audience. The leader begins to sing, although there is no microphone before him on the stage. His voice sounds, at first, relatively natural as his lyrics build over the musical accompaniment, but as he continues, his voice begins to change, to alter, becoming at first thin and mechanical and then, marvelously, it becomes a female voice—not a male falsetto, but a full, rich soprano—and then it doubles, becoming a unison chorus of both his original voice and the female voice. Then another voice joins in, and soon a full choral group has taken up the lyric.

Each of the musicians carries only his personal control units. The lead singer has a throat-mike. There are no wires; each has a small radio transmitter that broadcasts his input to offstage synthesizers and amplifiers. These in turn feed giant flat screens mounted at the rear of the stage which radiate sound uniformly from their entire surfaces, right through the thin curtains that mask their presence.

The singer is manipulating a computerized synthie which works on the same principle as the vocoder, taking his voice and analyzing its tonal structures and rebuilding the basic waveforms at his direction. Later in the concert he will "sing" a saxophone solo, his personal crowd-pleaser. The synthie will take the notes he sings and alter their timbre, attack and decay until the sound is remarkably like a tenor sax. (And no one will remark upon the irony of the fact that the tenor sax, of all the old-style acoustic instruments, could most resemble a human voice...)

The keyboard player is a traditionalist; he studied throughout his childhood to be a concert pianist, and refuses to give up a keyboard even in the face of ridicule from his fellow musicians—he feels comfortable with it, despite its bulk and weight. When offstage he likes to find an old piano and play the blues.

The musician with a small device in one hand is playing the rhythms; he is the "rhythm section." His device allows him to program the offstage sequencers which actually produce everything from staccato sequences of notes to an eerie recreation of a drum set, complete with funky backbeat. At the end of the concert, on the final encore, he likes to throw his control unit at the floor and stomp it into bits of plastic while the sequencers howl and rumble. It's a dramatic gesture and costs less than a decent meal to replace—he has boxes of them.

The fourth member of the group has his suit wired as a control unit. Every movement of his body is picked up and translated into sound—a sophisticated version indeed of the way a theramin is played. He represents the real wave of the future and knows it. He had eight years of intensive training in ballet before realizing in his adolescence that his body was going to be too large and too heavy for ballet and that he didn't really relate to old dance forms anyway. He knows that the music of tomorrow will be generated by people like himself—people who can totally integrate their body movements with their thoughts and feelings. He is totally self-absorbed, and when the group leaves the stage he's the one who will be mobbed backstage by the groupies who are drawn to his physical expressiveness.

Five years? Ten? No more than 20, for sure. The technology is already here and lacks only some refinement and imaginative people with talent to bend the technology to their creative impulses. Space-age technology will be enormously liberating for musicians who have a real creative drive and something of value to express.

perspectives

We have just passed an important anniversary and are on the eve of celebrating another. October 1, 1978, marked the 20th year of operation of our space agency, NASA. January 7, 1979, will mark the 50th anniversary of *Buck Rogers,* and yes—these two landmark events are historically connected.

When the first *Buck Rogers* newspaper strip appeared, America was still struggling its way into the 20th century. "Talkie" movies (as opposed to the silent films) were only two years old. Iceboxes were still commonplace as were horses for transportation and knickers for kids. In that age of the biplane, scientists were skeptical that the human body could survive traveling at the speed of sound and amateur astronomers had their telescopes glued to Mars in hopes of sighting Percival Lowell's mysterious "canals."

By the time Buck was 30 years old, America had survived two costly wars and was engaged in a battle of brinksmanship with the Soviet Union. The whole country had been recently traumatized by the successful Soviet space shots and the government and scientific community were revving up for the great "space race."

During that 30-year span, Buck Rogers had become part of the vernacular, as had many of the concepts that the strip introduced. Everyone knew what a disintegrator raygun was, that rockets carrying passengers could travel among the planets, that anti-gravity was possible, that rocket belts would replace cars and that scientific research—properly controlled—was the key to meeting the challenges of the future.

Many of the people touched and inspired by Buck eventually made names for themselves in the fields of science fiction and aerospace science. One of these luminaries is Ray Bradbury, another is Neil Armstrong.

Now, ten years after Armstrong took his "giant leap for all Mankind," NASA is in its third decade of operation and Buck is still going strong. . . Universal Studios are about to release a new, updated cinematic version of the first space hero.

But things are not going that well for the space agency. NASA is in a period of great peril, working with severely limited funds and in danger of having their budget reduced even further. Having successfully opened the road to space, NASA is about to launch the Age of Space Industry with its space shuttle program and plans for orbiting industrial parks. Of course this can't happen without the proper funding and, unfortunately, this program does not have a high government priority. It is sad to think that it may take another Russian space coup to galvanize this country into remembering that we should be in the forefront of humanity's next giant leap.

Cinematic fantasy is fine for entertainment, for exciting the soul and for firing the imagination. However, this is just a starting point. If we do not continue to fulfill our fantasies, we will dampen the imagination, rob the spirit and deny the next generation the chance to continue down the road that leads to humanity's destiny among the stars.

Howard Zimmerman

Howard Zimmerman/Editor

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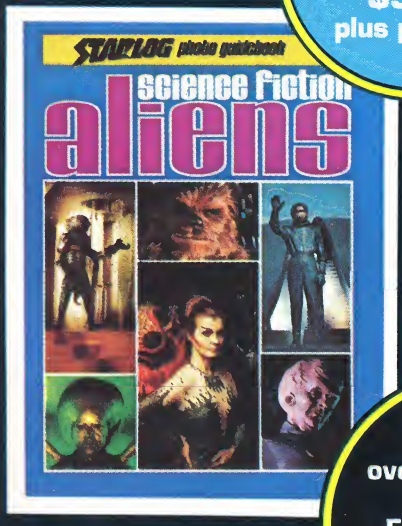

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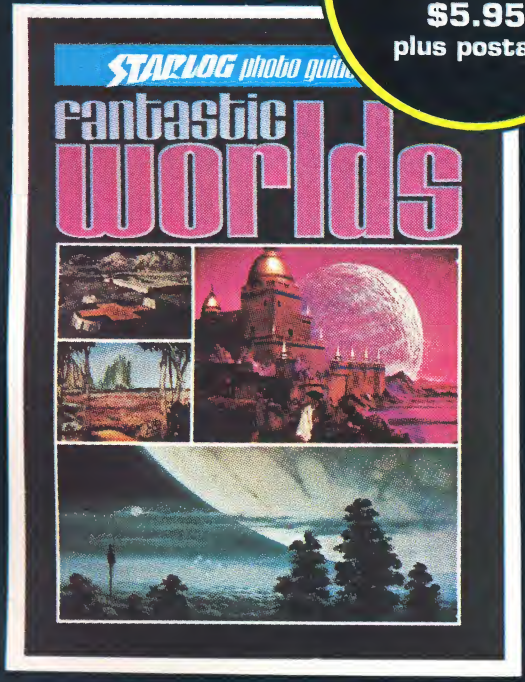

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